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COMMONWEALTH INSTITUTE OF ENTOMOLOGY.

REVIEW
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SERIES A.

Vol. 36. 1948.

VRYDAGH (J. M.). **Le problème du *Lyctus brunneus*, agent de la piqûre des bois.** —*Bull. agric. Congo belge* **37** no. 1 pp. 88–126, 4 figs., 41 refs. Brussels, 1946.

One of the most important of the wood-boring insects reported in South Africa as injuring timber imported during the war from other parts of that continent [*cf. R.A.E.*, A **34** 11] is *Lyctus brunneus*, Steph., which readily attacks limba (*Terminalia superba*), a useful wood from the Belgian Congo. Infestation probably arises in storage, and the Lyctid is known to have occurred in both South Africa and the Belgian Congo before the war. Investigations in the latter country by the author showed that it was abundant at Elisabethville but did not occur at Boma, the chief port of lading, though another Lyctid, *Minthea rugicollis*, Wlk., was common there. The introduction of large quantities of this wood has apparently favoured the infestation in South Africa and some treatment at the source to render it resistant has been considered necessary.

The author gives an account, taken largely from the literature, of the distribution and biology of *Lyctus* spp., and factors favouring attack by them, with short descriptions of the adults of the three African species, *L. brunneus*, *L. africanus*, Lesne, and *L. hipposideros*, Lesne. He also quotes a list of the timbers attacked by *L. brunneus* in South Africa [*cf.* **34** 12] and discusses methods of preventing damage by using only heartwood, by careful storage, by the elimination of starch from the wood [*cf.* **32** 289, etc.], by coating it with a protective material that covers the pores and so prevents oviposition in them, or by chemical impregnation [*cf.* **33** 84 ; **34** 12]. Impregnating the wood by soaking it for 1–2 hours in a 5 per cent. solution of zinc chloride or sulphate at 80°C. [176°F.] and then for the same period in cold solution gave irregular results, the depth of penetration varying with the hardness of the particular wood. The best method of eliminating infestation is treatment with moist heat [*cf.* **25** 669], but infested furniture can be treated with turpentine, petrol or a 5 per cent. solution of pentachlorphenol in white spirit, brushed over the surface or injected into the holes.

L. brunneus is attacked by the Clerid, *Tarsostenus univittatus*, Rossi, which is abundant both in the Belgian Congo and in South Africa, but does not give important control.

OOSTHUIZEN (M. J.). **Petrol as a Grain Fumigant.**—*Fmg in S. Afr.* 1945 repr. no. 6, 11 pp., 8 refs. Pretoria, 1945.

In view of a shortage of usual grain fumigants in South Africa, and of successful results obtained with petrol in other parts of Africa [*cf. R.A.E.*, A **31** 183],

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experiments were begun in November 1942 to test the effectiveness of commercial petrol (octane 68) and aviation spirit (octane 74) against *Calandra oryzae*, L., *Tribolium castaneum*, F., and *Bruchus* (*Callosobruchus*) *chinensis*, L. The vapours of these fluids, which are subsequently referred to as petrol and octane 74, were found to be, respectively, 2·8 and 3·7 times as heavy as air at normal temperature and pressure, and it is pointed out that the vapour of petrol is not lighter than that of carbon bisulphide [*cf. loc. cit.*], since the latter is stated to be only 2·6 times as heavy as air. The first tests were carried out in cylindrical grain tanks with a capacity of about 42 cu. ft. each holding about nine bags of grain. They were filled to within 6 ins. of the top with maize having a moisture content of 9 per cent., cages containing the experimental insects were placed at various heights in them, and 1 or 1½ pints petrol was poured directly over the surface of the grain or 1 pint octane 74 was poured into flat-bottomed receptacles on its surface. At 24°C. [75·2°F.], 1 pint petrol gave complete mortality of larvae of *T. castaneum* and adults of all three species in three days, and eggs of *C. oryzae* and larvae, pupae and adults of all species in four days. Exposure to octane 74 for five days at about 20°C. [68°F.] also killed larvae, pupae and adults of all species and eggs of *C. oryzae*, but exposure to 1 pint petrol for seven days, or 1 pint octane 74 for nine days was necessary to kill all eggs of *B. chinensis*, and even these exposures failed to destroy all those of *T. castaneum*. Since petrol and octane 74 were not used at the same temperature, no conclusions as regards their relative toxicity could be drawn, but 1½ pints petrol at about 23°C. [73·4°F.] was similar in effectiveness in three or four days to 1 pint at 24°C. The author considers that since the boiling point of petrol has been given as 70–90°C. [158–194°F.], better results would have been obtained had the experiments been conducted at higher temperatures. At 25·5–26·5°C. [77·9–79·7°F.], evaporation of 5 cc. octane 74 was complete after 1½ hours, whereas the same volume of petrol took 3 hours to evaporate and left a sticky residue.

In view of the resistance of the eggs, eggs of *T. castaneum* 1–16, 40–48 or 88–96 hours old in cages suspended in fumigation flasks were exposed to various dosages of carbon bisulphide, petrol and octane 74 at 21 or 23°C. [69·8 or 73·4°F.]. The results were variable, but indicated in general that the eggs of this beetle, and especially the newly laid ones, are extremely resistant to petrol and octane 74. It is concluded that at 21°C., with an exposure of 72 hours, carbon bisulphide was about 12 times as toxic as either to eggs 88–96 hours old, whereas at 23°C. with an exposure of 120 hours, it was 100 times as toxic as octane 74 and 150 times as toxic as petrol to eggs 1–16 hours old. Octane 74 was about twice as toxic as petrol to older eggs.

In further tests, in which the rates of application were equivalent to 1, 1½ or 2 pints per 10 bags of grain [about 40 cu. ft.] and the exposure was for seven days, 1½ or 2 pints petrol or octane 74 at a mean temperature of 19°C. [66·2°F.] killed all stages of *C. oryzae* in the centre of 5 lb. maize in fumigation flasks, but 1 pint failed to kill full-fed larvae and pupae. At 21°C., all dosages destroyed all stages of this weevil. At 16°C. [60·8°F.], 1 pint octane 74 or petrol gave complete mortality of larvae and adults of *T. castaneum* in the centre of 6 lb. wheat, and 1½ pints octane 74 or 2 pints petrol killed all the pupae but only about 30 per cent. of the eggs ; at 10°C. [50°F.], the survival of eggs and pupae was higher. When eggs of *B. chinensis* 2–3 days old were exposed in cages introduced into the centre of 2 lb. cowpeas at a mean temperature of 10°C., adults emerged after all treatments except octane 74 at 2 pints.

It is concluded that treatment for at least a week with either fumigant at the rate of 1 pint per 10 bags of grain kills all stages of the three insects except the eggs of *T. castaneum* ; when these are present, a second treatment is required, preferably two weeks after the first, since by this time the eggs will have hatched and the young larvae are easily destroyed. Fumigation should be carried out during the summer only, when temperatures are higher, and a fairly gas-tight

receptacle is essential. The viability of dry maize, wheat or cowpea seeds was not impaired by repeated fumigation with either material, even when the rate was 2 pints per 10 bags, and the unpleasant odour imparted to maize or wheat by frequent treatment with petrol was easily removed by aerating the milled products for about a week, but in view of the slightly higher toxicity of octane 74 and the absence of an objectionable odour, it is preferred to commercial petrol.

HERKLOTS (G. A. C.). **Vegetable Cultivation in Hong Kong.**—10½×7 ins., [4+] 208 pp., 86 figs., 3 fldg. tables. Hong Kong, the Author, 1947. Price Hong Kong $12.

This popular handbook contains a section (pp. 50–64) on the control of pests, chiefly insects, that attack vegetables in Hong Kong. The first part deals with measures against individual pests or groups of pests, and includes notes on the appearance, food-plants and life-cycle of some of them, and the second contains a brief survey of the history and use of derris, DDT and benzene hexachloride and the uses of paradichlorbenzene, together with a table showing the forms in which various insecticides are best applied against individual pests or groups of pests.

ALKAN (Bekir). **Tarım Entomolojisi.** [Agricultural Entomology.]—*Ankara Yüksek Ziraat Enst. Ders Kitab.* no. 31, vii+232 pp., 152 figs., 47 refs. Ankara, 1946.

This class-book for students in Turkey is divided into two parts. The first contains general accounts of the morphology and anatomy of insects, their modes of development and reproduction, their ecology, and their control by means of cultural, mechanical, chemical and biological methods, with notes on collecting, breeding and the preparation of specimens. The second contains sections on the various Orders and families, with brief accounts of their morphology and of the appearance, habits, bionomics, economic importance and, except in the case of beneficial insects, control of representative species that occur in Turkey. Species that are pests of crops are dealt with in more detail than others. There is an index to both Turkish and scientific names.

[RODIONOV (Z. S.).] **Родионов (З. С.). Pests of Vines in the Turkmen SSR.** [*In Russian.*]—*Uchen. Zap. mosk. gosud. Univ.* no. 83 Biol. pp. 132–144, 5 figs., 9 refs. Moscow, 1945.

Insect pests cause considerable loss of grapes in Turkmenistan, and since little is known about them, observations were made in 1941–42 near Ashkhabad. In one of two vineyards studied, the vines were trained on wires so that they were exposed to sun and air and the soil could be hoed, while in the other, they rested on the ground or were only slightly raised, so that the grapes, stems and many of the leaves were shaded and protected from the wind, and the soil could not be cultivated. The soil was baked, cracked and eroded in the first vineyard, the plants were rather dry and the berries were less juicy than those in the second, and many of them were scorched by the sun or injured by workmen when tying the vines to the wires.

Polychrosis botrana, Schiff., was the commonest pest, but its economic importance in Turkmenistan has been overrated in the past. In 1941, there were five generations, the larvae of the first appearing on 20th April and of the fifth on 5th September. A comparison of data obtained in the two years showed that the duration of the development of individual generations varies and that the later ones overlap. The period of greatest attack on the berries was between 6th and 12th July. The larvae and moths were present throughout the season in the vineyard with the vines trailing on the ground, particularly in a

part adjoining an orchard, but the vineyard in which the vines were exposed to the sun and air was free from infestation. In other vineyards, the larvae were scarce in plots that were not watered in summer so that the vines were not excessively developed, but abundant in a plot in which potatoes were grown between the rows of vines and which, consequently, was frequently watered. Dusting with calcium arsenate at the rate of about 6 lb. per acre at the end of June greatly reduced the numbers of larvae on the plants in July, but reinfestation occurred in August. Spraying with a mixture of nicotine sulphate or anabasine sulphate and soap was ineffective.

Gryllulus (*Gryllus*) *desertus*, Pall., which sheltered in cracks formed in the soil of vineyards after watering, caused considerable injury by feeding on the grapes and gnawing the stalks of individual berries or whole bunches. The leaves, and on hot and dry days also the berries, were attacked by the locust, *Calliptamus italicus*, L., which migrated to weeds in the vineyards at the end of May when the steppe became parched. In captivity, the locusts fed on the berries only after the insectary had been exposed for 20–30 minutes to the sun. In 1942, *G. desertus* and *C. italicus* each caused about 5 per cent. loss of crop in the vineyards surveyed. Dusting the vines and weeds with calcium arsenate destroyed all the locusts in 8–10 days, but more rapid mortality was obtained with baits of ground cottonseed cake and sodium arsenite (40 : 1), the latter dissolved in water, which killed all the locusts in four days and was of value against the crickets. The ripe berries are also injured by birds, and in some years by wasps.

On the basis of these observations, it is suggested that training the vines on espaliers is not suited to the conditions of Turkmenistan, since the berries become dry and sun-scorched and are exposed to birds. Watering in summer leads to the formation of deep cracks in the soil in which crickets shelter, and induces an excessive growth of young shoots, which form a dense cover between the rows of vines, hinder the cultivation of the soil and favour the mass development of *P. botrana*. If these shoots are pruned, the bunches are exposed to birds and liable to be scorched by the sun. Digging and watering the vineyards in winter is beneficial, as crickets and various root pests are suppressed. Dusting with calcium arsenate against *P. botrana* should be carried out when the second-generation moths are ovipositing, and repeated on late varieties during the oviposition period of the third generation. Poisoned baits should be applied as soon as locusts or crickets appear.

[Kovachevski (I. Kh.).] **Ковачевски (И. Х.). Die Viruskrankheiten der Paprikapflanze.** [The Virus Diseases of Peppers.] [*In Bulgarian.*]—*Arch. bulg. landw. Ges. Pflanzenb.* **1** pp. 25–102, 58 figs., 50 refs. Sofia [1942]. (With a Summary in German.)

Peppers [*Capsicum annuum*] are cultivated on a large scale in Bulgaria, but the yield is much reduced by virus diseases. Field and laboratory studies were carried out by the author over three years on the symptoms, transmission and host range of these diseases, and an account of his observations, supplemented by data from the literature, is given. Tests on transmission were carried out by abrasion of leaves and with Aphids.

The most serious disease was that caused by the cucumber-mosaic virus (*Marmor cucumeris* of Holmes); it occurred in late summer in all pepper plantations and affected all the plants in some of them. Of the nine species of Aphids that have been recorded in the literature as vectors [*cf. R.A.E.*, A **27** 687], only *Aphis gossypii*, Glov. (*Doralis frangulae*, auct.), which migrated to peppers from cucumbers, and *Myzus persicae*, Sulz., were observed in large numbers on peppers in the field, and both proved effective vectors in transmission tests. The next most important virus was that of tobacco mosaic

(*Marmor tabaci* of Holmes). Examples of *Myzus persicae* collected from severely infected tobacco or pepper plants in the field did not transmit it to healthy peppers, but the author assumes that Aphids may play a part in its dissemination. A less serious disease was a mosaic attributed to *Marmor medicaginis* var. *typicum* of Black & Price, an account of which has been noticed from a German version of this section of the paper [**31** 369].

Potato virus Y (*Marmor cucumeris* var. *upsilon* of Holmes) attacked only 2–5 per cent. of peppers in the field, though it was common in potato and tobacco. It was fairly easily transmitted to peppers by *Myzus persicae* from peppers, potatoes or tomatos, whereas infection by abrasion was less successful. Potato virus X (*Marmor dubium* of Holmes) was uncommon in peppers, since it is not transmitted by insects and the smoothness of the leaves renders infection through contact less likely. Potato aucuba-mosaic virus (*Marmor aucuba* of Holmes) was rare, though severe in its effects ; repeated trials gave no evidence of transmission by *Myzus persicae*.

A severe leaf curl that was common on peppers, especially in hothouses, was found to be due not to a virus, since it was not transmitted either by sap or by *Myzus persicae*, but to the feeding of an Aphid resembling *Macrosiphum solani*, Kalt. (*Aulacorthum pseudosolani*, Theo.) that was taken on *Convolvulus arvensis* in the field. The injury was apparently caused by the saliva of the insect and usually affected only the lower parts of the plants.

Notes are given on the symptoms, geographical distribution and mode of transmission of eight virus diseases that have been recorded as occurring in peppers or as having been transmitted to them experimentally, but have not been observed in peppers in Bulgaria.

Control measures are briefly reviewed ; they include spraying against Aphids, the eradication near the plantation of peach trees on which *Myzus persicae* overwinters in the egg stage, the destruction of crop remains, a rotation of crops that will avoid the growing of peppers in ground that has been under tobacco, peppers or tomatos in the preceding year, destruction of weeds that serve as hosts for the viruses, and the use of healthy seed. A key is appended for the identification of some of the virus diseases of peppers based on the symptoms caused and in some cases the vector.

DE TOLEDO (A. A.). **Estudos estatísticos da infestação num cafezal pela broca *Hypothenemus hampei* (Ferr., 1867) (Col.-Ipidae).** [Statistical Studies of the Infestation of a Coffee Plantation by *Stephanoderes hampei*.]—*Arq. Inst. biol.* **16** pp. 27–39, 2 graphs, 1 ref. São Paulo, 1945. (With a Summary in English.)

In the course of investigations on *Stephanoderes* (*Hypothenemus*) *hampei*, Ferr., on coffee in Brazil, it became necessary to devise a method of estimating the degree of infestation of a plantation, and experiments were begun using samples of 200 fruits taken from different parts of the tree. In 1941, 12 such samples were collected in June–July from each of 295 trees ; they were taken from the lower branches and from those at one-third and two-thirds of the height on the north, south, east and west sides. Only six samples per tree were taken in 1942, from the lower branches on all four sides and from those two-thirds of the way up on the east and west sides, but the trees sampled were divided according to their topographical situation into three groups : those growing in ravines having north and south exposures, respectively, and those from the crests of ridges. Highly significant variations were found between the rates of infestation of samples taken on different sides and at different heights, the attack being most intense on the lower branches and diminishing with height ; but when the infestation of the samples was compared

with the total infestation of the crop at harvest, high correlations were found, irrespective of the position of the trees and of the place on the tree from which the sample was taken.

Regression equations showing the relations between sample and total infestations were worked out from these results, using the six samples available from both years. In no case was the equation for a given sample identical in the two years, but a combination of the results for the samples taken from the lower branches on the north side and from the east side at two-thirds of the height produced a formula that was almost identical in both years. In 1943 and 1944, samples were again taken from these positions; the discrepancies between the equations for all four years were found to be extremely slight, and from them was derived a mean regression equation. Comparison with the data obtained in 1942 showed the differences between the calculated and actual total under different topographical conditions to be negligible. When the results from 25, 50 and 100 samples were compared, it was found that 50 gave sufficiently accurate results for practical purposes, although 100 gave greater exactitude. As a further simplification, it is suggested that when dealing with quantities such as 100 samples each of 400 fruits, it is sufficient if they are well mixed together and samples for examination taken at random from the mass; or the samples may be collected by volume instead of by number.

MONTE (O.). **Observações biológicas sôbre** *Coelosternus granicollis* (**Pierce**), **broca da mandioca.** [Biological Observations on *C. granicollis*, the Cassava Borer.]—*Arq. Inst. biol.* **16** pp. 89–110, 2 pls., 1 fig., 17 refs. São Paulo, 1945. (With a Summary in English.)

The author gives a list of seven species of *Coelosternus* recorded as attacking cassava in Brazil and the West Indies [*cf. R.A.E.*, A **28** 403; **31** 163; **32** 30] and describes all stages of *C. granicollis*, Pierce, which is an important pest of this crop in São Paulo [*cf.* **11** 442] and Minas Gerais. Cassava is cultivated throughout that region and is left in the fields from one season to another; it also grows wild. Both the sweet and the bitter variety were attacked, and no difference in resistance was observed. The injury was serious in some cases, a large proportion of the plants being damaged or destroyed, but relatively slight in others. The estimation of losses was complicated by the fact that yields varied greatly with climate and soil conditions. No alternative food-plants were discovered. In the laboratory the adults caused serious injury to stalks of cassava by feeding on the surface; in nature, this injury is not important, the main damage being caused by the larvae, which bore in the stems, weakening the plant and reducing the starch-content of the roots. The weevils are active throughout the year except during the coldest months, and infestation is spread by the transport of infested cuttings.

During 1942–44, studies of the life-history of *C. granicollis* were made in the field and in the laboratory, and the technique and apparatus used are described. Under field conditions, the eggs were laid in holes bored by the female in the cassava stem and afterwards concealed. In the laboratory, the egg larval and pupal stages of two typical individuals lasted 4, 54 and 20 and 5, 67 and 22 days, respectively. The larvae tunnelled in the pith and pupated in cells in the galleries, the adult emerging through the wall of the cell. Pairing took place two days after emergence, and was sometimes repeated, and oviposition began three days later. The numbers of eggs laid per female ranged from 35 in 36 days to 374 in 358 days, with a daily average of 0·92. The adults survived for an average of 86 days, and the numbers of males and females were about equal.

Suggested control measures comprise the destruction of infested stems, clearing and ploughing the fields after harvest and, in cases of heavy infestation, the cultivation of other crops for 1–2 years.

Nobrega (N. R.) & Silberschmidt (K.). **Sôbre uma provavel variante do virus " Y " da batatinha (*Solanum* virus 2, Orton) que tem a peculiaridade de provocar necroses em plantas de fumo.** [On a suspected Variant of the Potato Virus Y that causes Necrosis on Tobacco Plants.]—*Arq. Inst. biol.* **15** pp. 307–330, 3 pls., 20 refs. São Paulo, 1944.

Orlando (A.) & Silberschmidt (K.). **Estudos sôbre a transmissão da doença de virus de solanáceas " necrose das nervuras ", por afídios, e algumas relações entre esse virus e o seu principal inseto-vetor.** [Studies on the Transmission by Aphids of " Vein Necrosis ", a Virus Disease of solanaceous Plants, and on some Relations between this Virus and its principal Insect Vector.]—*Op. cit.* **16** pp. 133–152, 23 refs. São Paulo, 1945. (With Summaries in English.)

In the first of these papers, an account is given of investigations in São Paulo on a disease found in a potato plant of a Peruvian variety, which is considered to be caused by a strain of potato virus Y [*Marmor cucumeris* var. *upsilon* of Holmes]. The physical properties of the virus and the symptoms caused, which include severe necrosis of the veins in tobacco of the variety White Burley, are described and compared with those of similar viruses recorded in the literature [*cf. R.A.E.*, A **28** 434]. In experiments on host range, the virus was transmitted by sap inoculation from infected tobacco to tobacco, three other species of *Nicotiana* and tomato, but not to various other solanaceous plants, including two species of *Nicotiana* and *Datura stramonium*, which is immune from the typical virus Y. In experiments with possible Aphid vectors, several generations of *Myzus persicae*, Sulz., and *Macrosiphum solanifolii*, Ashm., were reared on plants not susceptible to virus Y, and large numbers in various stages of development were starved for 3–4½ hours, allowed to feed for 5–60 minutes on leaves of infected tobacco and then placed on healthy tobacco seedlings. All the 19 seedlings exposed to *Myzus persicae* and 4 of 15 exposed to *Macrosiphum solanifolii* developed the disease, the symptoms in both cases being identical with those produced by mechanical transmission.

Further investigations on transmission by these Aphids are described in the second paper. They were carried out in 1944–45. The Aphids were reared in the same way and both the stock from which the experimental individuals were drawn and the potato plants raised from seed tubers were shown to be free from infection before use. In the tests of transmission to potato, the infective Aphids were left on the plants for up to 10 days and then destroyed ; sap from these plants was inoculated two months later into tobacco plants, in which the symptoms of the disease are more readily observed than in potato.

The Aphids did not become well established on tobacco, although they both occur on it in the field, and when 380 examples of *Myzus persicae* were left on an infected tobacco seedling, only 48 were found after eight days. Of these, 30 transmitted the virus when allowed to feed in a batch on healthy tobacco, but a further eight did not. In a similar test, the 33 survivors of 300 examples allowed to feed on infected tobacco for four days transmitted the virus to tobacco. In the further experiments with tobacco as a source of infection, the Aphids were kept without food for 3–4 hours and then allowed to feed on diseased leaves for 30 minutes ; no attempt was made to obtain natural colonisation. With this method, the virus was transmitted by batches of 50 or more individuals of *M. persicae* to 37·5 and 83·3 per cent. of potato plants of two varieties, respectively, and by batches of 15–20 to 62·5 and 66·6 per cent. of a third. Batches of 15–20 individuals of *Macrosiphum solanifolii* transmitted the infection from tobacco to 39·13 per cent. of potato plants of this

last variety. When the Aphids were allowed to colonise infected potato plants and were transferred in batches of 30–40 to healthy tobacco or potato, the percentages of plants infected by *M. persicae* and *Macrosiphum*, respectively, were 87·5 and 50·0 for tobacco, 100 and 66·66 for potatoes of the second variety and 52·11 and 30·77 for those of the third.

Studies on the relation between vector and virus were made with *Myzus persicae* only, as it had proved the more effective vector, and with tobacco seedlings. Batches of 30 fasting Aphids were fed on infected leaves for a maximum of 15 minutes, and transferred to 4 or 5 successive plants, on each of which they were allowed to feed for 15 minutes. The first plant became infected in all the nine tests, indicating that the incubation period of the virus in the insect does not exceed 30 minutes, but in no case was the virus transmitted beyond the fourth plant, suggesting that infectivity is lost within one hour [*cf.* **29** 27]. In two tests, the virus was transmitted to the first and third plants, but not to the second. This appears to contradict a theory of purely mechanical transmission and is evidence for the participation of some movement or act on the part of the insect. When varying numbers of Aphids were used, single individuals infected 25 per cent. of the plants, batches of three and five 37·5 per cent., batches of 10 and 15 62·5 per cent., and batches of 20 and 30 all the plants. Preliminary fasting was found to be important only when a very short feeding time was allowed on the infected plant. Batches of up to five Aphids that fasted for 3–4 hours and then fed for 2–5 minutes on infected tobacco transmitted the virus to 33·3 per cent. of healthy plants, while those that had not fasted did not transmit it to any; when allowed an infecting feed of 30 minutes, Aphids that had and had not fasted transmitted the virus to 40 and 33·3 per cent. of healthy plants, respectively [*cf.* **28** 301; **35** 204–205].

Duval (G.). **Uma nova espécie de** *Lissorhoptrus* **Lec. (Col.-Curc.).** [A new Species of *Lissorhoptrus*.]—*Arq. Inst. biol.* **16** pp. 337–342, 1 pl., 6 figs., 5 refs. São Paulo, 1945. (With a Summary in English.)

A description is given of the adults of both sexes of *Lissorhoptrus foveolatus*, sp. n., the larvae of which caused serious damage to irrigated rice in the State of São Paulo, Brazil, in 1945, together with a character distinguishing the adults from those of *L. bosqi*, Kuschel, *L. simplex*, Say, and *L. oryzae*, Costa Lima [*cf. R.A.E.*, A **34** 171].

Wolfenbarger (D. O.). **Dispersion of small Organisms. Distance Dispersion Rates of Bacteria, Spores, Seeds, Pollen, and Insects; Incidence Rates of Diseases and Injuries.**—*Amer. Midl. Nat.* **35** no. 1 pp. 1–152, 181 graphs, 9 pp. refs. Notre Dame, Ind., 1946. Reprints obtainable at $1·00 post paid.

The distance to which organisms disperse is important in planning their control, and to provide quantitative information on the subject, the author analyses published data on the horizontal and vertical dispersion of small animate and inanimate objects. The results are shown on graphs relating the incidence of inanimate objects, plants (including fungi and bacteria), viruses and insects to the horizontal distance from the source and of insects and micro-organisms (bacteria, fungi and pollen) to the height above it. Consideration of these indicates that dispersion may be initiated by internal factors, such as the reproductive impulse, hunger, periodicity of habit or gregariousness, or by external influences such as overcrowding, shortage of food, change of food conditions, quantity or quality of light, temperature and moisture conditions, wind, or the intervention of other organisms, and that the distances to which organisms disperse depend on the species, activity, generation or phase involved. A general discussion on horizontal and vertical dispersion includes notes on the

direction of dispersion, migration (movements between localities in one or both of which breeding occurs), means and agents of dispersion, the effect on dispersion of density level at the source, and the relation of dispersion to the application of control measures. A few of the general problems involved in relating dispersion and incidence to distance are indicated.

PETERSON (A.). **A Manual of entomological Equipment and Methods. Parts I and** [illustrations of] **II.**—5th edn., 11 × 8½ ins. [4+] 24 pp., pls. 1–124, [2] pp., pls. 125–138, [2] pp., pls. 139–160, 13 tables, xiv pp., multigraph. Ann Arbor, Mich., Edwards Bros., Inc., 1947.

This volume contains all the information on equipment and methods for entomological investigations that was given in the first edition of Part I [*R.A.E.*, A **22** 632], together with the illustrations from Part II [**25** 346]. Additional matter includes notes on methods of killing larvae for preservation and dissection, information on chemicals useful in producing specified relative humidities in closed containers, instructions for inflating larvae and restoring dried specimens, especially of immature insects, to their normal size and shape, and illustrations of new collecting equipment.

ZIMMERMAN (O. T.) & LAVINE (I.). **DDT—Killer of Killers.**—8×5½ ins., xi+180 pp., 24 figs. Dover, N.H., Industr. Res. Serv. 1946. Price $3.

This popular book is concerned primarily with the use of DDT in the control of pests of medical and veterinary importance, but it includes information of general interest on its discovery, its development as an insecticide, its chemical and physical properties, its toxicity to vertebrate animals, its insecticidal action, the forms in which it is available for insecticidal purposes, and its effect on beneficial insects, and brief sections, some in an appendix, on its use against pests of crops and forests, and ants, termites and clothes moths.

BRETT (C. H.). **Insecticidal Properties of the Indigobush** (*Amorpha fruticosa*).—*J. agric. Res.* **73** no. 3 pp. 81–96, 5 figs., 13 refs. Washington, D.C., 1946.

The author describes investigations on the insecticidal properties of *Amorpha fruticosa*, a North American leguminous plant that gave colour reactions thought to indicate the presence of rotenone in the roots, stems, bark and seeds, but was subsequently found to contain a glycoside reacting to the rotenoid tests [*cf.* *R.A.E.*, A **32** 222]. The toxic principle (here termed amorpha) has not been determined, but it occurs chiefly in resinous pustules on the pods, these pustules varying greatly in size and abundance. Fruits from individual plants grown in Oklahoma were tested biologically as a guide to the selection or breeding of plants to give a high yield of insecticide. The seeds were seriously infested by *Bruchus* (*Acanthoscelides*) *floridae*, Horn, which was parasitised by *Horismenus missouriensis*, Ashm., *Eupelmus cyaniceps amicus*, Gir., and *Catolaccus* spp., the first being extremely prevalent, and galls were formed on the terminal stems by the larvae of *Walshia amorphella*, Clem., which were parasitised by *Microgaster ecdytolophae*, Mues., and *Pristomerus euryptychiae*, Ashm.

Laboratory and field tests on 29 species of insects and mites [*cf.* also B **36** 6] with sprays, generally aqueous emulsions prepared by adding standardised acetone extracts of the unground fruits to distilled water, and dusts, prepared by pouring an acetone extract into walnut-shell flour, stirring until most of the acetone had evaporated and allowing to dry, showed that amorpha acts as both stomach and contact poison. No highly toxic extract was obtained, but more than 80 per cent. control was obtained in the laboratory in tests of dusts against *Blissus leucopterus*, Say, *Aphis gossypii*, Glov., *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.), *Cerotoma trifurcata*, Forst., and *Diabrotica duodecimpunctata*, F.,

and a repellent effect was exerted for more than twelve hours. In aqueous extracts injected into cockroaches, amorpha was about one tenth as toxic as derris containing 4·7 per cent. rotenone. An experiment with guineapigs indicated that it would probably be poisonous to mammals if taken internally, but no effect was noted on the skin.

PEAY (W. E.). **Tomato Fruitworm Control. Accurate Predictions of Infestations can aid in Control Operations.**—*Fm & Home Sci.* **7** no. 2 pp. 3–4, 3 figs. Logan, Utah, 1946.

The percentages of tomatos damaged by the fruitworm [*Heliothis armigera*, Hb.] in Utah varies in different years from 25 to less than 1 ; there were two severe outbreaks and four moderate ones during the years 1934–45. In tests of insecticides, dusts of undiluted calcium arsenate and of cryolite containing 70 per cent. sodium fluoaluminate applied fortnightly from the time when the fruits are 1½–2 ins. in diameter have given the best results, with 70–80 per cent. control, based on the relative numbers of damaged tomatos at harvest ; dusts containing 5 per cent. DDT have shown promise in preliminary experiments. The adoption of an effective control programme has been hindered by the sporadic nature of the outbreaks, and the possibility of forecasting the intensity of infestation early in the year was therefore investigated in 1941–45, when field observations were made on the relation between the number of eggs on the plants and the percentage of damaged fruits at harvest. The data indicate that damage to 2–4·5 and 4–9 per cent. of the fruits at harvest is probable when the numbers of eggs present in July average 1 and 2 per 100 leaves, respectively. Fairly strong evidence was obtained of the occurrence of three generations in the year, with peaks in the numbers of larvae in July, August and late September or early October. It is not known whether infestation is originated by moths that immigrate from the south in spring or whether the pupae overwinter in Utah. A few pupae survived the winter in hibernation cages in some years, but not in others.

In 1944 and 1945, outbreaks of the yellow striped armyworm [*Prodenia ornithogalli*, Gn.], which is sporadically injurious, occurred on tomato in several localities and caused considerable damage. The eggs are laid in masses, so that infestation in the fields is generally patchy, unless the moths are abundant. The larvae can be controlled by dusting the infested areas or the whole field, if necessary, with undiluted calcium arsenate or cryolite.

VANSELL (G. H.) & TODD (F. E.). **Alfalfa Tripping by Insects. Bees important in Alfalfa Seed Production.**—*Fm & Home Sci.* **7** no. 2 pp. 9–10, 4 figs. Logan, Utah, 1946.

Observations over two years in Utah showed that wild bees of the genera *Megachile*, *Nomia* and *Bombus* and honey bees (*Apis*) were the only insects that effectively pollinated lucerne [*cf. R.A.E.*, A **35** 363, etc.]. The maximum numbers of *Megachile*, *Nomia* and *Apis* observed per acre were 160, 14,500 and 29,000, respectively, and the maximum numbers of flowers tripped by individuals of the three genera while under continuous observation and (in brackets) per minute were 158 (15), 78 (10) and 129 (7). In many fields with low insect populations, scarcely any of the flowers were tripped. *Nomia* was sufficiently abundant in only four places to be of importance, and all of them were near alkali flats in which the bees nested. There is one generation a year, and the adults appear in July ; very few occurred farther than half a mile from the nests. *Megachile* was widely distributed, but nowhere very numerous ; it was more frequent in hilly districts with much uncultivated land than in the valleys.

Honey bees freely visited lucerne for nectar, but did not trip many flowers when collecting it, except in autumn and under certain undetermined conditions. Those collecting pollen tripped the flowers freely, but other plants are preferred for pollen and, where they were available, the lucerne was not visited. In the Delta area, 39 per cent. of the bees that visited a field of dry, stunted lucerne during one day were collecting pollen and 59 per cent. of the flowers were tripped, whereas only 14 per cent. of the bees collected pollen in an adjacent field in which growth was succulent, and 12 per cent. of the flowers were tripped ; in three other fields, of which one was dry, one wet and the other very wet, the percentages of flowers tripped in one day were 26, 8 and 3, respectively. Honey bees were the only insects numerous enough in this area to cause seed to set on a commercial scale. Observations in 1928–36 showed that when the number of colonies of honey bees moved to lucerne fields throughout the State fell much below 10,000, the amount of seed produced was also reduced, but increased again when the number of colonies rose above 10,000. At a lucerne ranch on which there were no honey bees, *Nomia* was abundant and it was estimated that there were as many as 7,000 per acre on flowers near the nests. *Bombus* was also more abundant there than elsewhere. In many places, wild bees were scarce after the ploughing of preferred nesting sites. Insecticides should be used with caution on seed lucerne, owing to the risk of injury to bees, and where wild bees do not occur or are scarce, the establishment of apiaries near the lucerne fields should be encouraged.

Knowlton (G. F.) & Peay (W. E.). *Lygus* **Control on Sugar Beets grown for Seed. Dusting with 10 per cent. DDT increases Seed Production.**—*Fm & Home Sci.* **7** no. 2 pp. 11–12, 3 figs. Logan, Utah, 1946.

Studies on the effect of *Lygus* spp. on the yield and viability of sugar-beet seed were begun in Utah in 1942, following low yields and poor germination of seed harvested in 1941. Surveys showed that *L. elisus*, Van D., *L. hesperus*, Knight, and *L. oblineatus*, Say, were all present in numbers ; *L. elisus*, which is the least injurious [*cf. R.A.E.*, A **32** 217], was the most abundant. In 1943, the Mirids became numerous early in May, and 20 per sweep of the net were taken on 14th May, when the plants were 4–7 ft. high and had passed the peak of the flowering period. A dust containing 0·2 per cent. pyrethrins as pyrethrum extract and 50 per cent. sulphur at a rate of approximately 30 lb. per acre was applied on this date by horse-drawn dusters with a clearance of 52 ins. and fitted with canvas trailers 15–20 ft. long. The control of adults and nymphs obtained 24 hours later varied in different fields from 83 to 97 per cent. and from 94 to 99 per cent., respectively. A rate of about 35 lb. per acre appeared to be more effective in fields in which the plants were 7 ft. high and of dense growth. Infestation was not severe enough to warrant control measures in 1944, but in 1945, when pyrethrum dusts were extensively used, they were less effective, especially when the sulphur was omitted from them. The dust of pyrethrins and sulphur was compared with others containing 5 per cent. DDT or 20 per cent. sabadilla in an experiment in which applications were made by means of hand equipment at a rate of 35 lb. per acre as the plants were coming into full bloom. Unfavourable weather followed, and *Lygus* populations in the control plot became so low that no difference in the germination of the seeds could be detected. Populations were reduced about equally by DDT and sabadilla, and to a less extent by pyrethrum. Plants dusted with 5 per cent. DDT at a rate of 30 lb. per acre on 2nd July, when they were 2½–3 ft. high and in the bolting stage, were protected for 23 days, which was sufficiently long for the seeds to develop beyond the stage at which attack would cause noticeable damage. There was no appreciable fresh infestation of undusted plants, but since seed beet in southern Utah frequently becomes infested as it comes into flower by adults from lucerne fields, applications should for the present be made when the plants are in full flower.

Peay (W.) & Sorenson (C. J.). **Yield of Onion Seed increased by Thrips Control.**—*Fm & Home Sci.* **7** no. 2 p. 12. Logan, Utah, 1946.

The production of onion seed has become of importance in Utah in recent years, but the seed has failed to develop in certain areas. Since *Thrips tabaci*, Lind., was abundant in these areas and not in others in which good crops were obtained, the effect of its control on seed production was investigated in 1945. Dusts containing 5 and 10 per cent. DDT in pyrophyllite were applied in small randomised plots on 9th May, when the flower buds had formed, and again on 24th May, when the flowering heads, but not the flowers, had opened. The dusts had reduced the thrips populations on the heads by 73 and 93 per cent., respectively, after two days and increased the yield of cleaned seed to 236 and 300 lb. per acre, as compared with only 92 lb. from undusted plots. Further investigations are necessary before final recommendations are made; DDT should not be applied to the plants when they are in full flower, owing to the risk to pollinating insects.

Bishopp (F. C.). **The Insecticide Situation.**—*J. econ. Ent.* **39** no. 4 pp. 449–459, 28 refs. Menasha, Wis., 1946.

The author gives an account of developments that took place in the use of insecticides in the United States during the war years, largely owing to shortages of the materials formerly used. R. T. Cotton & J. C. Frankenfeld found that magnesium oxide mixed with stored seed at the rate of 1 oz. per bushel and 3 per cent. DDT in magnesium oxide used at ½ oz. per bushel gave excellent protection against insects [*cf. R.A.E.*, A **34** 177] when the moisture content of the seed was not over 12 per cent. Walkden & Schwitzgebel have shown that the addition of 5–10 per cent. ethylene dibromide to grain fumigants greatly increases the mortality of insects in the surface layers, 2–4 U.S. gals. of a 9 : 1 mixture of carbon tetrachloride and ethylene dibromide per 1,000 bushels giving excellent control of insects in wheat stored in farm bins. Insects in flour-milling machinery were also controlled by tri-weekly fumigation of the units with the standard mixture of ethylene dichloride and carbon tetrachloride [**33** 235] or with a 1 : 1 mixture of acrylonitrile and carbon tetrachloride [*cf.* **31** 404], supplemented by other measures for general insect control in the mill.

The plant formerly reported as *Erigeron affinis* [*cf.* **34** 359] has been found by E. L. Little & S. F. Blake to be almost certainly *Heliopsis longipes*. In preliminary tests with dusts prepared from *Ryania speciosa* [*cf.* **34** 137], a 50 per cent. dust heavily applied gave good control of chinch bugs [*Blissus leucopterus*, Say] on small grains, but none of the corn earworm [*Heliothis armigera*, Hb.], when applied to 3- or 4-day-old maize silks. Sprays containing 6 lb. *Ryania* per 100 U.S. gals. largely prevented the larvae of the codling moth [*Cydia pomonella*, L.] from entering apples, though not from causing superficial injuries to them. In laboratory tests, very good kills were obtained with a concentration of 4 lb. per 100 U.S. gals. Cage tests showed 5 per cent. *Ryania* dust in pyrophyllite to be as effective as sulphur but much less so than 5 per cent. DDT against the tarnished plant bug [*Lygus oblineatus*, Say] on cotton. Since dusts containing 25–50 per cent. *Ryania* were not effective against the pea Aphid [*Macrosiphum onobrychis*, Boy.] in Wisconsin, the pea weevil [*Bruchus pisorum*, L.] in Idaho or *H. armigera* on beans in Virginia and less effective than other insecticides against the Mexican bean beetle [*Epilachna varivestis*, Muls.] and the striped cucumber beetle [*Diabrotica melanocephala*, F.] in Ohio, the squash bug [*Anasa tristis*, Deg.] and onion thrips [*Thrips tabaci*, Lind.] in California, the sweet-potato weevil [*Cylas formicarius*, F.] in Louisiana, and the

harlequin bug [*Murgantia histrionica*, Hahn] and cabbage caterpillars in South Carolina, this material does not appear to be a promising insecticide for vegetable crops. Laboratory tests against several species of Aphids, the large milkweed bug [*Oncopeltus fasciatus*, Dall.] and red spiders [*Tetranychus*], carried out by G. T. Bottger & C. Bowen, indicated that nicotine and nornicotine [*cf.* **32** 128] are of a similar order of toxicity, but that anabasine is more toxic than either to all but *Oncopeltus*.

In preliminary tests on apple in Indiana, the addition of 4 lb. of a commercial preparation containing 25 per cent., 2′-hydroxy-2,4,4,4′,7-pentamethylflavan to a spray of 1 lb. DDT per 100 U.S. gals. water kept populations of *Tetranychus* and the European red mite [*Paratetranychus pilosus*, C. & F.] comparatively low, caused no injury except on foliage of a weak branch on one tree, and did not impair the effectiveness of DDT against *Cydia pomonella*, but the application to a *Citrus* tree of 1 lb. of a dust containing 10 per cent. of the flavan compound gave only partial control of the citrus red mite [*P. citri*, McG.] and the citrus rust mite [*Phyllocoptruta oleivorus*, Ashm.] in Florida. A 10 per cent. dust was effective against *H. armigera* and *E. varivestis* on beans in Virginia, but not against the latter in Ohio. It was ineffective against the boll weevil [*Anthonomus grandis*, Boh.] and *L. oblineatus* on cotton. This compound is said to be less injurious to foliage and less toxic to warm-blooded animals than DDT.

In tests of benzene-hexachloride dusts, one containing about 5 per cent. γ isomer gave an average of about 97 per cent. control of four species of Aphids on potato. A poorly prepared dust containing about 5–7 per cent. γ isomer, used at 20 lb. per acre, gave very good control of grasshoppers, and a good quality talc dust containing 2 per cent. at the same rate gave about 50 per cent. mortality. Benzene hexachloride knocked down white-fringed beetles [*Pantomorus* (*Graphognathus*)] very quickly, but killed them very slowly, possibly by starvation due to loss of co-ordination. In cage tests, complete mortality was obtained with a mixed dust applied at 1 oz. γ isomer per acre and 50 per cent. kill with 0·25 oz. per acre. A dosage of 4 oz. γ isomer per acre caused no foliage injury to field crops and ornamental plants, and a mixed dust applied at the rate of 2·5 lb. γ isomer per acre in the top three inches of soil caused no injury to oat, rice and cowpea seeds and seedlings, whereas rates of 5 lb. or more per acre stopped germination and growth. In small preliminary cage tests, benzene hexachloride (probably containing about 3 per cent. γ isomer) was highly effective against the sugar-cane borer [*Diatraea saccharalis*, F.] and the rice stinkbug [*Solubea pugnax*, F.]. In laboratory tests, sprays of 1–4 lb. benzene hexachloride (10–12 per cent. γ isomer) per 100 U.S. gals. were less effective against *Cydia pomonella* than equivalent quantities of DDT, but in later tests sprays containing 1 lb. γ isomer per 100 U.S. gals. were very effective, and others containing 8 oz., though less effective, were much more so than lead arsenate. When benzene hexachloride containing 35 per cent. γ isomer was ground with kaolin and applied on 30th August as a 5 per cent. dust and as a spray prepared to contain 8 oz γ isomer per 100 U.S. gals. to apple trees in Indiana that had received earlier cover sprays of DDT, the dust was less effective than a DDT spray; harvested fruit from the tree sprayed with benzene hexachloride had a musty flavour that rendered it unsaleable. A few tests in Arizona showed that benzene hexachloride is toxic to honey bees in contact with very minute quantities, the knockdown time being rather short, but death not very rapid.

It has been found that 1,1-dichlor-2,2-bis(parachlorphenyl)ethane, which has been referred to as DDD, TDE and Rothane, is toxic to a number of insects that attack agricultural crops, including the southern armyworm [*Laphygma eridania*, Cram.], the southern beet webworm [*Psara bipunctalis*, F.] and *C. pomonella*. In preliminary tests, it gave good control of *Heliothis armigera*, comparing favourably with DDT when atomised on maize silks or injected into them as an emulsified solution in oil. In the Pacific Northwest, a 5 per

cent. DDD dust was less effective than one of 5 per cent. DDT against *Macrosiphum onobrychis* and *Bruchus pisorum* on peas and less effective than rotenone against the latter. In field tests in Virginia, the methoxy analogue of DDT, 1,1,1-trichlor-2,2-bis(paramethoxyphenyl)ethane, applied to beans as a 10 per cent. dust, was as effective as a 0·5 per cent. rotenone dust against *E. varivestis*, but ineffective against *H. armigera*. In plot tests, it gave excellent control of grasshoppers as a 20 per cent. dust at 20 lb. per acre and as a 10 per cent. dust with 0·1 per cent. pyrethrins and 1 per cent. of a mixture of substituted piperonyl cyclohexanones at 30 lb. per acre, and in cage tests it gave good kill of adults of *Pantomorus* (*Graphognathus*), with quick knockdown but very slow mortality, when applied as a spray at 2 lb. per 100 U.S. gals. water per acre. Preliminary tests indicated that it is toxic to larvae of *Pantomorus* when applied to the soil. Dosages of 4 lb. or more per acre caused no foliage injury, and a dose of 100 lb. per acre did not injure plants when mixed with the soil. The methoxy compound was less effective than DDT against *L. eridania*, the sugar-beet webworm [*Loxostege sticticalis*, L.] and the bean leaf-roller [*Urbanus proteus*, L.], ineffective against *Lygus oblineatus* on cotton, much less effective than calcium arsenate against *A. grandis*, and almost non-toxic to the European corn borer [*Pyrausta nubilalis*, Hb.]. When mixed with seed wheat at the rate of 0·1 per cent. by weight, it caused complete mortality of the rice weevil [*Calandra oryzae*, L.] and the confused flour beetle [*Tribolium confusum*, Duv.]. The bromine analogue, 1,1,1-trichlor-2,2-bis(parabromophenyl)ethane, was less effective than DDT against the squash borer [*Melittia cucurbitae*, Harr.], less toxic than derris to *E. varivestis* and as toxic as lead arsenate to *Laphygma eridania*.

A German material (Bladan), of which the hexaethyl ester of tetraphosphoric acid is the active ingredient, is claimed to be an excellent substitute for nicotine in controlling Aphids.

REINHARD (H. J.). **Life Histories of some Texas** *Phyllophaga*.—*J. econ. Ent.* **39** no. 4 pp. 475–480, 8 refs. Menasha, Wis., 1946.

The results are given of further laboratory studies of the life-cycles of species of *Lachnosterna* (*Phyllophaga*) in Texas [*cf. R.A.E.*, A **33** 270], those dealt with being *L.* (*P.*) *torta*, Lec., of which the adults frequently cause severe defoliation of pecan and elms in the centre of the State in June and July and also feed on plum, rose, hackberry [*Celtis occidentalis*] and fig and the larvae have once been reported as associated with extensive injury to young wheat; *L.* (*P.*) *submucida*, Lec., which is more widely distributed over the State than *L. torta*, is at least as destructive to pecan and elm and also feeds to some extent on willow, sycamore [*Platanus occidentalis*], *Citrus* and *Tamarix*; *L.* (*P.*) *hirtiventris*, Horn, which is less abundant locally than the first two species, but is widely distributed over the eastern half of the State and feeds on elm, oak, pecan, willow and hackberry; and *L.* (*P.*) *rubiginosa*, Lec., which is generally distributed over the eastern two-thirds of the State from the northern to the southern border, appears to be one of the principal species of which the larvae injure pasture grasses, and has been collected in the adult stage from oak, elm and other plants.

The following is based on the author's summaries of the life-histories. Most of the adults of *L. torta* emerge in June, and oviposition begins during the same month. The average durations of the egg, larval and pupal stages are 18, 320 and 28 days, respectively. With access to ample food, the larvae develop rapidly and attain full growth by October. The winter is passed in the larval stage and pupation occurs in late May and June. The life-cycle normally lasts one year, but 32 of 396 larvae did not pupate until the second spring after reaching maturity. The life-history of *L. submucida* is similar, the egg, larval and pupal stages averaging 20, 334 and 26 days, respectively, and some

individuals requiring two years to complete their development. Adults of *L. hirtiventris* emerge early in the season and fly in maximum numbers during April. Oviposition becomes general during this month. If suitable food is available, the larvae become full-grown during September; they remain quiescent until about the middle of the following July, when they pupate. The adults pass the winter in the pupal cells and emerge in the following spring. The egg, larval and pupal stages average about 32, 432 and 25 days, and the complete life-cycle two years. *L. rubiginosa* has a similar life-history, the life-cycle lasting two years and the egg, larval and pupal stages 26, 424 and 28 days, respectively.

MARTIN (C. H.). **Effect of Phloem Condition and Phloem Moisture on the Entry of *Scolytus multistriatus*.**—*J. econ. Ent.* **39** no. 4 pp. 481–486, 2 figs., 11 refs. Menasha, Wis., 1946.

The author describes experiments carried out in Oregon in 1935–37 to determine the period of attractiveness of cut elm logs to *Scolytus multistriatus*, Marsh., and the effect of the degree of decadence of the phloem and its moisture content on the numbers of oviposition tunnels made in it. The adult beetles were active from the last week of May to mid-September, and logs cut during this time were entered in 2–3 days or less. Those cut at other times and left in the field were entered practically as soon as adult activity began, so that the longest pre-infestation period was 8½ months, for logs cut on 15th September, but this period was extended to ten months or more by keeping the logs in cold storage at 32°F. or in basement storage at a mean of 60°. Logs with the shortest pre-infestation periods had the heaviest infestations. The period between the first and last entries was less than ten weeks, most of the beetles entering within four weeks of the initial attack, so that logs cut before the end of June ceased to be attractive before adult activity ceased.

Phloem was considered to be alive if it was the same colour as that from living trees, decadent if it was discoloured on the surface or streaked with dead phloem, and dead if it was brown throughout. It died more rapidly when the logs were cut in May and June and exposed to rising summer temperatures, than when they were cut in July or August. Live and decadent phloem attracted several times as many beetles as phloem that had been dead for up to four weeks, and phloem that had been dead for longer than this did not attract beetles. The moisture content of the phloem did not affect beetle entry, any apparent correlation being due to the incidental association of moisture content and degree of decadence. Larvae in the early instars did not survive in dead phloem. The reactions of *Hylastes* (*Hylurgopinus*) *rufipes*, Eichh., to decadence and moisture of the phloem were similar. The adults entered dead phloem rather more frequently than did those of *S. multistriatus*, though they generally preferred living or decadent phloem, and the larvae tolerated dead phloem better.

WEBBER (H. H.), WAGNER (R. P.) & PEARSON (A. G.). **High-Frequency Electric Fields as lethal Agents for Insects.**—*J. econ. Ent.* **39** no. 4 pp. 487–498, 6 figs., 23 refs. Menasha, Wis., 1946.

An account is given of experiments on the use of high-frequency electric fields to control insects [*cf. R.A.E.*, A **24** 424] in packaged materials, particularly foodstuffs. The test package was put between the condenser plates of a commercial generator capable of developing electric fields of high intensity, and the voltage applied across the condenser was measured by means of a capacity potentiometer. Methods of calculating the field intensity and the rate of increase of temperature in the package are shown. In the initial empirical experiments, commercial packages of cereals of various sizes, some

with wax wrappers, others wrapped in cellophane and none having completely homogeneous contents were used, but inconsistent results were obtained; in most cases arcing resulted before lethal temperatures were reached, the temperature maxima did not increase proportionately to the exposure periods and the killing effect was not consistent for the various periods of exposure. Standard packages of cardboard containing sifted bleached wheat flour were therefore used to eliminate disturbances from differences in wrappings and contents, and these were artificially infested with larvae of *Ephestia kuehniella*, Zell., and larvae, pupae and adults of *Tribolium confusum*, Duv. The packages were put in the electric field for measured lengths of time, the temperature of the flour being noted immediately before and after treatment and again when it reached a maximum, usually about three minutes later, and then kept at 25°C. [77°F.] for one day, after which the flour was sifted and the number of dead insects determined; both living and dead insects were kept under observation for several weeks. The field applied to the packages had a frequency of eleven megacycles per second, and the field intensities ranged from about 1,200 to 1,700 volts per cm. and the treatment periods required for complete mortality from about 20 to 40 seconds. It was found that the number of insects killed was directly correlated with the maximum temperature attained in the packages and that there was no difference in susceptibility between the two species. Insects that survived treatment continued to live for a month and produced offspring that completed their development, indicating that the electric field had no appreciable debilitating effect on survivors. More closely controlled observations are necessary before it can be concluded that any factor other than temperature is involved at the frequency tested. The possibility of using an external source of heat to maintain the atmosphere surrounding the irradiated package at a temperature approximating the lethal temperature, in order to reduce heat loss from the surface, is suggested. The temperature effects considered in these tests may represent merely the secondary influence of the radiated or conducted heat of the flour, and investigations of the fundamental physiological influences of high-frequency electric fields are necessary to aid in the interpretation of the cause of death. It is concluded that under the maximum practical field intensity at which these data were obtained, the minimum temperature necessary to achieve complete mortality in the shortest time is approximately 70°C. [158°F.].

STAFFORD (E. M.). **The Application of measured Amounts of Petroleum Spray Oils to individual Olive Scales.**—*J. econ. Ent.* **39** no. 4 pp. 499–503, 5 refs. Menasha, Wis., 1946.

In the course of investigations on the control of *Parlatoria oleae*, Colv., on olive in California, it was found that the continued use of medium to heavy spray petroleum oils (40 to 10 per cent. by volume distilling at 636°F.) resulted in reduced yields of olives and that light oils (64–79 per cent. distilling at 636°F.), though not injurious to the trees, gave poor control of the scale. Investigations were therefore carried out on the effect of adding toxic agents to light summer oil. The areas of leaf surface covered by individual non-ovipositing adult females on Japanese privet [*Ligustrum japonicum*] were determined, measured amounts of oil or oil and insecticide were applied to the scales with a micropipette, and the numbers of living and dead scales were ascertained by microscopic examination after 10–14 days.

In tests made in 1943, the addition of 11 per cent. mutual solvent containing derris resins (30 per cent. rotenone) to give 0·06 per cent. rotenone in the oil increased the toxicity of light, medium and heavy summer oils. The increase was greatest for the light oil, for which the median lethal dosages with and without the rotenone were $0{\cdot}7 \times 10^{-6}$ and $2{\cdot}3 \times 10^{-6}$ cc. per sq. mm. of leaf surface covered by the scale. The addition of the solvent alone decreased the toxicity

of medium oil, and the solvent and rotenone without oil showed no toxicity, possibly owing to the very low viscosity of the solvent. These results were confirmed by tests in which the same materials were emulsified and applied as sprays containing 2 per cent. oil to infested privet leaves.

In tests in 1944, a dosage of 10^{-6}cc. per sq. mm. was used throughout ; as it was well within the sublethal dosage range for the light summer oil, any increase in effectiveness due to the added toxic agent would have to be considerable for the scales to be killed. The addition of 1, 2 or 4 per cent. nicotine alkaloid or triamylamine, 2 or 4 per cent. Lethane 60 (containing not less than 50 per cent. β-thiocyanoethyl esters of fatty acids with 10–18 carbon atoms), 1 or 2 per cent. DDT, 1 per cent. 1,1-dichlor-1-nitroethane, or 0·5 per cent. Vatsol-OT (dioctyl sodium sulphosuccinate) with 0·2 per cent. diethylene glycol monobutyl ether caused little or no increase in the toxicity of the light summer oil, whereas the addition of rotenone as ground cubé root or derris resins increased it in all cases. An apparent synergism of petroleum extractives of cubé root and Velsicol AR-60 (methyl naphthalenes) was observed, light summer oil containing 0·06 per cent. rotenone alone, 1 per cent. Velsicol alone and 0·03 per cent. rotenone with 0·5 per cent. Velsicol killing 75, 5 and 100 per cent. of the scales, respectively.

WOLFENBARGER (D. O.). **Observations on the Airplane for Application of Sprays and Dusts.**—*J. econ. Ent.* **39** no. 4 pp. 503–505. Menasha, Wis., 1946.

The author discusses the use of aeroplanes for the application of insecticides and reports observations on the deposits of dusts and sprays obtained with them. The number of particles or droplets was greatest under the aeroplane and decreased towards the margin of the swathe covered. The width of this varied with the height of flight and wind velocity. When slides were exposed 3–14 inches above the ground below the line of flight and a spray applied from a machine flying at a height of 8–10 ft., the upper surfaces received more than nine times as many spray particles as the lower. Almost as many droplets were deposited on low as on high slides, but the proportion on the under surface was slightly greater for the higher ones, and both the total number of droplets and the proportion on the lower surface were higher on one day than on another.

GOODHUE (L. D.). **Aerosols and their Application.**—*J. econ. Ent.* **39** no. 4 pp. 506–509, 15 refs. Menasha, Wis., 1946.

This discussion of various methods of applying insecticides in aerosol form is based chiefly on the literature. It includes references to the production of aerosols by incomplete combustion of materials containing insecticides, by spraying an oil solution of insecticides on a hot surface to form a vapour that immediately condenses into a fog when cooled by contact with air, and by mechanical means, such as air-atomising nozzles and revolving discs, but deals chiefly with those generated by liquefied gases [*cf. R.A.E.*, A **31** 349] and thermally generated aerosols formed by heating a mixture of water and an oil solution of the insecticide until the water is converted into superheated steam, which breaks up the insecticide solution into aerosol-sized droplets when released through a nozzle [*cf.* **35** 120, 259].

The particles in an aerosol range from 0·5 to 50 microns in diameter ; above this range the advantage of being airborne is lost. Particles smaller than 0·5 micron are of little insecticidal value, because a lethal dose is collected too slowly by the insect ; to achieve comparable results, an aerosol with one-micron particles requires an exposure 85 times as great as one with ten-micron particles. The most effective range for confined spaces is 10–20 microns. Increasing the

velocity of a small particle increases its effectiveness because more kinetic energy helps it to pass through the streamline layer of air round the insect. Small slow-moving particles are not easily deposited. For outdoor use, the particle diameter of a drifting aerosol should be about ten microns in order to allow as much coverage as possible. The velocity imparted by the wind gives sufficient precipitation on the insect.

The use of liquefied-gas aerosols against mosquitos and other insects in houses and experiments with them against greenhouse and field-crop pests [*cf.* **34** 239–244] are reviewed, and possible methods of reducing the cost of the small dispersers known as aerosol bombs are discussed. In thermal-generated aerosols, the range of particle size can be regulated by varying the viscosity of the oil or the temperature to which it is heated. A relatively non-volatile oil solvent for DDT should be used, or the aerosol particles will shrink too rapidly by evaporation during application. Thermal-generated aerosols are for large-scale use ; they are applied out of doors by drifting the cloud across the desired area under meteorological conditions that will hold it close to the ground. Inversion conditions (a layer of colder air next to the ground) are the most favourable and usually occur during the periods near dawn and dusk. A wind movement of 1–4 miles per hour is desirable. Since the concentration of these aerosols is greatest nearest the generator and diminishes with distance, it is necessary to overdose the intervening area to obtain a high degree of control at a distance, and it is therefore more economical to treat in narrow strips than in wide ones.

COON (B. F.). **Resistance of Soybean Varieties to Japanese Beetle Attack.**—*J. econ. Ent.* **39** no. 4 pp. 510–513, 1 fig. Menasha, Wis., 1946.

Investigations were carried out in Pennsylvania in 1944, in which 26 varieties of soy beans planted on 16th and 17th May at Manheim and on 2nd and 3rd June at Lancaster, were tested for resistance to defoliation by the Japanese beetle [*Popillia japonica*, Newm.]. Feeding reached its maximum by the end of July, and all the varieties were susceptible, but whereas early varieties made most of their growth before and during the period of beetle activity, late ones continued to grow after the beetles had disappeared and so recovered from the injury. Varieties that matured late were taller and produced more hay than those that matured early. Grain yields increased with increases in the height of the mature plants to a certain point, beyond which they decreased, possibly because excessive plant height was made at the expense of grain production.

MARTIN (C. H.). **Influence of Characteristics of the Puncture in Potatoes on Parasitism of Potato Tuber Moth by** *Macrocentrus ancylivorus*.—*J. econ. Ent.* **39** no. 4 pp. 516–520, 2 refs. Menasha, Wis., 1946.

Preliminary experiments having shown that the populations of *Macrocentrus ancylivorus*, Rohw., bred from *Gnorimoschema operculella*, Zell., in potato tubers in the laboratory in California [*cf. R.A.E.*, A **32** 367] were 1·2–3 times as large when the punctures made in the skin to enable the host larvae to enter were round as when they were slit-like, observations were made to determine whether the characteristics of the puncture affected the parasite population directly or indirectly through their effect on the host population. For this purpose, punches were used to produce cylindrical, tapered and slit punctures of various sizes and depths. It was found that increasing the diameter of the puncture from 0·5 to 1–1·5 mm. significantly increased the numbers of moths produced in the absence of parasites, whereas a further increase to 2·6 mm. had variable effects ; that increasing the depth from 2 to 5 mm. increased the numbers of moths in slit and tapered punctures but not in cylindrical ones ;

and that there was a general tendency for the larger tapered and cylindrical punctures to yield more moths than the largest slits, though shape had little effect in the case of the smallest punctures.

The effects of these characters on parasitism were found to be both indirect, changes in moth population tending to result in corresponding changes in parasite population, particularly in the case of shallow punctures, and also direct, the percentage parasitism being greater at a depth of 2 mm. than at 5 mm., though there was no significant difference between the actual numbers of parasites produced, and smaller numbers being bred from potatoes with slit punctures than from the others. Other physical features, including the healing of the puncture and the way in which the punch cut the skin of the potato, which affected the moth populations, the closing of the slit punctures with flaps of skin by the action of the punch, which reduced parasitism, and the rate and direction of the entry of the host larva into the potato flesh, which also affected it, are discussed.

FARRAR (M. D.) & WRIGHT (J. M.). **Insect Damage and Germination of Seed treated with DDT.**—*J. econ. Ent.* **39** no. 4 pp. 520–522. Menasha, Wis., 1946.

As dusts containing 5 per cent. or more DDT protected wheat and maize seed from insects during two years of storage when added at the rate of 1 oz. per bushel, further tests were carried out with seeds of wheat, barley, oats, maize (several varieties), squash, muskmelon, cucumber, watermelon, beans, peas, tomatos and lettuce. Dusts containing 0·5, 1, 2·5, 5, 10 and 20 per cent. DDT with Pyrax [*cf. R.A.E.*, A **35** 392] were added to them at the rate of 1 oz. per bushel, and they were stored in open bags along with untreated seeds in a room in which grain insects were abundant. Examination of samples after one year of storage showed that dusts containing 2·5–20 per cent. DDT gave excellent protection, no seed being injured in some samples, whereas those containing 0·5 or 1 per cent. were much less effective. The insects found in infested seeds were *Plodia interpunctella*, Hb., *Tribolium confusum*, Duv., *T. castaneum*, Hbst., *Laemophloeus minutus*, Ol., *Oryzaephilus surinamensis*, L., *Calandra* (*Sitophilus*) *granaria*, L., *C.* (*S.*) *oryzae*, L., and *Rhizopertha dominica*, F. Seeds that had been treated with dusts containing 5, 10 and 20 per cent. DDT germinated satisfactorily when tested by a standard method.

DEAN (F. P.), NEWCOMER (E. J.) & WESTLAKE (W. E.). **Cryolite for Codling Moth Control in the Pacific Northwest.**—*J. econ. Ent.* **39** no. 4 pp. 523–526, 1 fig., 3 refs. Menasha, Wis., 1946.

The following is based on the authors' summary of this account of experiments carried out in Washington during 1925–44 on cryolite sprays for the control of *Cydia* (*Carpocapsa*) *pomonella*, L., on apple. It was found that cryolite gave successful control under arid conditions provided that an adhesive was used with it, and that dogfish oil, tar soap, a colloidal spreader and emulsified mineral oil were satisfactory for this purpose. When cryolite was not used for the entire season, the results were equally good whether it was used in the early or late applications [*cf. R.A.E.*, A **34** 73]. A less highly refined cryolite, containing 70–75 per cent. sodium fluoaluminate, was as effective as the standard material containing 90 per cent. [*cf.* **33** 22]. As a rule, cryolite used at 3 lb. per 100 U.S. gals. spray with 1 or 2 U.S. quarts emulsified mineral oil and a little colloidal spreader resulted in the same control as lead arsenate used in the same manner [*cf.* **31** 354]. It did not affect the size of Rome or Delicious apples and probably not that of Winesap, but Jonathan apples sprayed with it did not grow quite so large as those sprayed with lead arsenate.

Shaw (J. G.) & Starr (D. F.). **The Effect of Smoke on the Mexican Fruitfly.**—*J. econ. Ent.* **39** no. 4 pp. 526–528, 4 refs. Menasha, Wis., 1946.

The following is based on the authors' summary. Experiments carried out in 1943 and 1944 in the state of Morelos, Mexico, showed that the smoke from burning mango leaves or rice straw repelled the adults of *Anastrepha ludens*, Lw., and greatly reduced the numbers caught in bait traps suspended in mango trees; in one instance the effect of the smoke lasted for three days. In cage tests, flies became agitated immediately they were exposed to smoke produced by burning mango leaves or rice straw, and many regurgitated for several minutes and then rubbed their bodies constantly with their legs. After about an hour, when the smoke had leaked from the cage, they resumed normal activity. Flies kept in stoppered flasks with smoke from mango leaves were dead within 13 hours.

Although no records were kept of the infestation of mangos on trees that were smoked, the slightness of the residual effect observed would indicate that continued smoking for many days would be necessary to protect fruit on the trees.

Cotton (R. T.) & Walkden (H. H.). **Toxicity of Nitriles to stored-grain Insects.**—*J. econ. Ent.* **39** no. 4 pp. 529–531, 1 ref. Menasha, Wis., 1946.

The minimum dosages of 21 nitriles that gave complete kill when adults of *Tribolium confusum*, Duv., and *Calandra* (*Sitophilus*) *oryzae*, L., were exposed to them for 24 hours in 20-litre flasks at a constant temperature of 80°F. and a relative humidity of 70–80 per cent. are shown in a table. Tests made in similar flasks filled with wheat showed that most of them were absorbed to such an extent by the surface layer of grain that they did not show promise as grain fumigants. Apart from acrylonitrile and trichloracetonitrile [*cf. R.A.E.*, A **31** 404], 2-chloracrylonitrile was the most toxic compound under these conditions.

In large-scale tests, mixtures of nitriles with carbon tetrachloride (1 : 9) [*cf. loc. cit.*] and carbon tetrachloride alone were applied as coarse sprays evenly over the surface of wheat in steel bins having a temperature of 60–80°F., at the rate of 1 U.S. gal. per 1,000 bushels wheat. Test insects, including adults of *C. oryzae*, the lesser grain borer [*Rhizopertha dominica*, F.], the long-headed flour beetle [*Latheticus oryzae*, Waterh.], the red flour beetle [*Tribolium castaneum*, Hbst.], the flat grain beetle [*Laemophloeus minutus*, Ol.] and the saw-toothed grain beetle [*Oryzaephilus surinamensis*, L.] were exposed at various depths in the wheat. The mortality percentages of these insects given after 72 hours by 2-chloracrylonitrile, 2-chloracetonitrile, 2,2,3-trichlorpropionitrile and 2,2,3-trichlorbutyronitrile were 100 (or almost 100), 98, 95 and 93, respectively, in bins of 1,000 bushels capacity (depth of wheat 7 ft.) and 93, 97, 93 and 90, respectively, in bins holding 2,740 bushels (12 ft.), as compared with 96 in the small bin and 90 in the large one for carbon tetrachloride alone. It was evident that the addition of the 2-chloracrylonitrile or 2-chloracetonitrile resulted in a slight though definite increase in the effectiveness of carbon tetrachloride in bins of both sizes, apparently owing to the higher mortality obtained in the upper parts of the wheat. Since better kills appeared to be obtained at the top of the bins with mixtures containing 2-chloracrylonitrile and at the bottom with 2,2,3-trichlorbutyronitrile, a mixture of 5 per cent. of each of these compounds in carbon tetrachloride was tested, and this gave complete kill in both large and small bins at a dosage of 1 U.S. gal. per 1,000 bushels.

English (L. L.). **The Velvetbean Caterpillar on Peanuts : Control Experiments.**—*J. econ. Ent.* **39** no. 4 pp. 531–533, 2 graphs, 1 ref. Menasha, Wis., 1946.

In further tests of dusts for the control of *Anticarsia gemmatalis*, Hb., on ground-nuts [*Arachis hypogaea*] in south-eastern Alabama [*cf. R.A.E.*, A **29**

251], where it was very injurious in 1944, the relative effectiveness of three cryolite products and DDT were compared, and attempts were made to determine the number of applications of cryolite necessary for the control of the larvae and the optimum time to dust. The dusts were applied downwards towards the tops of the plants at the rate of about 20 lb. per acre when the air was still, either late in the afternoon or early in the morning. Yield records were taken on 28th September and 9th October. Kryocide (natural cryolite containing 90 per cent. sodium fluoaluminate), applied on 17th and 28th August and 7th September or on either or both of the first two dates, and Kryocide D-50 (45 per cent. sodium fluoaluminate and 23·25 per cent. sulphur), Alorco cryolite (synthetic cryolite containing 85 per cent. sodium fluoaluminate) and a 3 per cent. DDT dust, applied on 28th August, all gave significantly higher yields on 28th September than no treatment, whereas treatment with Kryocide on 7th September only did not. The yields on this date did not show any significant difference between insecticides. Yield records on 9th October showed that losses increased with larval populations and delay in digging. There was no significant difference or reduction in the yields from plants treated with natural and synthetic cryolite on 28th August, but there were considerable losses in yield between the two dates from those treated with Kryocide D-50 on 28th August or with Kryocide on 17th August only. Three applications of Kryocide did not give significantly higher yields than two, and the yield from the plot given two treatments was only slightly higher than that from the plot dusted once on 28th August. There was an actual gain in yield between the two digging dates on the plot treated with DDT ; this was probably not statistically significant, but may indicate that DDT is more effective than cryolite under critical conditions.

It appeared that the single application of Kryocide on 17th August was too early to maintain control throughout the season and that the one on 7th September was too late to prevent damage. The week from 28th August to 5th September was the critical period, the larval population increasing rapidly between these dates and remaining high until the food-supply was depleted.

Comparison of the harvested and total yields on the two dates indicated that infestation causes not only a direct reduction due to impaired plant production but also an increase in the proportion of pods detached and left in the ground.

Lathrop (F. H.) & Kierstead (L. G.). **Black Pepper to control the Bean Weevil.**—*J. econ. Ent.* **39** no. 4 p. 534, 4 refs. Menasha, Wis., 1946.

In tests in Maine of common household materials for the protection of stored beans against *Bruchus* (*Acanthoscelides*) *obtectus*, Say, sodium bicarbonate, table salt and wheat flour were ineffective, but black pepper [*Piper nigrum*] gave promising results. Various samples of 385 gm. uninfested beans were mixed with measured amounts of ground black pepper on 21st December 1945 and ten adults of *B. obtectus* and about 24 beans from a heavily infested source were added to each sample and also to similar untreated ones. They were kept in a tightly closed container at room temperature (65–80°F.) until 9th April 1946, when infestation counts showed that no treatment and treatment with 1·06, 2·13 and 4·26 gm. black pepper per 385 gm. resulted in averages of 5,021·5, 1,107, 190 and 104·5 adults, 81·5, 40·75, 8·5 and 6·5 per cent. beans visibly infested and 81, 39·5, 8·5 and 6·25 per cent. beans having exit holes. Although these results appear to indicate satisfactory protection under laboratory conditions, further experiments are needed to ascertain the effectiveness of black pepper on a larger scale and under conditions more like those met with in household and farm storage.

Questel (D. D.). **DDT and hibernating Larvae of the European Corn Borer.**—*J. econ. Ent.* **39** no. 4 p. 535. Menasha, Wis., 1946.

In view of a suggestion that it might be possible to kill larvae of *Pyrausta nubilalis*, Hb., by disking DDT into the soil with the maize stalks in which they are hibernating, laboratory experiments were carried out to determine the mortality of larvae buried in soil treated with DDT. Dusts containing 5 and 20 per cent. DDT micronised on clay were stirred into moist soil in buckets to a depth of a little more than an inch at a rate equivalent to 10 and 40 lb. DDT per acre, respectively, and a solution of about 5 per cent. DDT in deodorised kerosene was applied to the surface soil at rates equivalent to 10 and 20 lb. DDT per acre. Hibernation-type larvae were put into holes in the soil one inch deep and two inches in diameter, covered with treated soil and left for seven days at 70°F., the kerosene being allowed to evaporate for 24 hours before the borers were buried in some cases. The subsequent condition of the larvae and the causes of death, where they could be ascertained, are shown. The numbers of larvae killed or affected by DDT or kerosene were low in all tests except for the larvae buried immediately in soil treated with the solution, in which case the kerosene was probably responsible.

Mortality from disease averaged 2·08 per cent. in treated soil and 38·3 per cent. in untreated soil, this indicating that the DDT was controlling the disease to some extent. It is considered that the quantities of DDT used were more than would be practical under field conditions and that disking DDT into the soil with infested maize stalks would not be of value, especially as it decreases the mortality due to disease.

Wilson (J. K.). & Choudhri (R. S.). **Effects of DDT on certain microbiological Processes in the Soil.**—*J. econ. Ent.* **39** no. 4 pp. 537–538. Menasha, Wis., 1946.

In view of the possibility that DDT applied for the control of insects might interfere with microbial processes in the soil, investigations were made on its effect on certain organisms normally found there. A dust of 25 per cent. DDT in talc, mixed with soil in proportions much higher than are applied as insecticides, did not appear to modify the concentration of soluble salts, the accumulation of nitrate in the soil or the production of ammonia from organic matter, in periods of 7–24 days. It also appeared to have no injurious effect on the nodulation of leguminous plants or on the growth of microorganisms either in the soil or in pure cultures on agar jelly.

Bottger (G. T.) & Levin (C.). **Comparative Toxicity to Insects of Benzene Hexachloride and DDT.**—*J. econ. Ent.* **39** no. 4 pp. 539–541, 1 ref. Menasha, Wis., 1946.

In the tests described, benzene hexachloride (pure γ isomer) and technical DDT were compared in the laboratory for the control of various insects. They were diluted with fuller's earth and applied as dusts or, with a wetter, as sprays to parts of plants, with which nearly full-grown larvae were subsequently confined for three days. The results from the dusting experiments showed that benzene hexachloride was more effective than DDT at equal rates against *Diaphania hyalinata*, L., *Psara* (*Pachyzancla*) *bipunctalis*, F., *Laphygma* (*Prodenia*) *eridania*, Cram., and *Heliothis armigera*, Hb., and more so than DDT at higher rates against *Cirphis unipuncta*, Haw., *Haltica* (*Altica*) *bimarginata*, Say, and *Pieris rapae*, L., but it was less effective than DDT at an equal rate against *Phlyctaenia rubigalis*, Gn. (giving no mortality at all) and less so than DDT at a lower rate against *Peridroma saucia*, Hb. (*margaritosa*, Haw.). Against nymphs of *Oncopeltus fasciatus*, Dall., which were dusted and then enclosed with untreated food, the hexachloride was much more effective than

DDT at an equal rate. In the sprays, benzene hexachloride was more effective than DDT against *Pieris rapae*, *Psara bipunctalis* and *L. eridania*, but less so against *D. hyalinata*.

Sprays containing the two insecticides were applied to the green foliage of several kinds of plants in phytotoxicity tests, but the only injury observed was a very slight sclerosis that developed on pumpkin leaves sprayed with the benzene hexachloride, and this did not appear to affect the subsequent development of the plants.

BLACKBURN (N. D.). **Rearing Oriental Fruit Moths and Parasites from infested Peach Terminals.**—*J. econ. Ent.* **39** no. 4 pp. 542–543. Menasha, Wis., 1946.

The numbers of adult moths and parasites reared from samples of peach terminals are used in Ohio as a basis for calculating the degree of parasitism of twig-infesting larvae of *Cydia* (*Grapholitha*) *molesta*, Busck. In the normal method of rearing, the bare twigs are put in glass jars with several green apples as supplementary food, both twigs and apples being sometimes wrapped in paper towelling, and strips of corrugated paper are put inside the top of the jar, which is covered with fine-mesh cheesecloth. Since it is difficult to eliminate the excess humidity caused by evaporation of moisture from the green terminals, mould and disease organisms commonly attack the twigs within a few days, with the result that many of the emerging insects become entangled in moist débris and are overlooked when emergence is recorded. This difficulty is only partly overcome by transferring the corrugated paper to another container when the cocoons have been found in it, as some larvae are lost in the accumulated moisture and others construct their cocoons in twigs and die or produce adults that fail to emerge in the decaying material; this is particularly true in the case of larvae parasitised by *Angitia* (*Inareolata*) *obliterata*, Cress.

Many of the objectionable features of this method were eliminated by a new technique, in which each sample of infested terminals (usually not exceeding 125) was wrapped in paper towelling in the field, moistened and put into a covered cylindrical pasteboard container with one or two small green apples and strips of corrugated paper. If the paper towelling round the twigs was liberally moistened once a day for 5–6 days, the terminals remained in excellent condition in the closed container and many were almost entirely consumed by the larvae. Occasionally, it was necessary to remove a sample and separate the twigs, which had become massed too tightly together. At the end of 8–10 days, each sample with the towel wrapper and corrugated paper was divided into two or more parts, depending on the size, and these were placed in glass containers in which emergence could more easily be recorded. When samples were not moistened for a few days before transfer, they usually remained relatively free from mould throughout the entire emergence period and insects that were overlooked in routine examinations were recovered from the dry débris when the apparatus was dismantled, but if they were too moist they were left longer in the cardboard container. The greater efficiency of the new method is demonstrated by the fact that an average of 43·4 per cent. of the terminals collected in 1943 and 1944, when the earlier rearing method was used, failed to produce either moths or parasites, whereas in 1945, with the improved technique, only 22·7 per cent. were unproductive.

STAHLER (N.). **A new Lacebug in Florida.**—*J. econ. Ent.* **39** no. 4 pp. 545–546, 1 fig., 1 ref. Menasha, Wis., 1946.

In view of the possible economic importance of *Leptopharsa machalana vinnula*, Drake & Hambl., which was described in 1946 from material taken on *Bidens pilosa radiata* in Florida in May 1942, the author gives brief notes on the

bionomics and appearance of this Tingid. The adults feed and oviposit on the underside of the leaves and have been taken only on *B. p. radiata* and *Urena lobata*, though the eggs have been collected from *Boehmeria cylindrica drummondiana*. Breeding was continuous in Florida from April to November in 1945, the population being lowest in September, when many dead adults were found on the leaves with hyphae of a fungus, *Hirsutella* sp., protruding from their bodies. Females were 2–3 times as abundant as males.

In the insectary, the Tingid was reared on several varieties of snap and lima beans, though there was no indication that these plants were preferred to the wild food-plants, and did not feed or oviposit on plants of 24 other species. The preoviposition period lasted two days, and the longest oviposition period 41 days. Females lived for up to 56 days and laid up to 106 eggs. The egg and nymphal stages averaged 9·2 and about 11 days, respectively.

KNOWLTON (G. F.) & NYE (W. P.). **Lizards feeding on Ants in Utah.**—*J. econ. Ent.* **39** no. 4 pp. 546–547, 1 ref. Menasha, Wis., 1946.

KNOWLTON (G. F.), ROBERTS (R. S.) & WOOD (S. L.). **Birds feeding on Ants in Utah.**—*T.c.* pp. 547–548, 1 ref.

Ants cause important losses in Utah, where harvester ants, particularly *Pogonomyrmex occidentalis*, Cress., clear vegetation from large areas of range land and lucerne fields and other species make nests in gardens, build mounds that damage mowing equipment in the fields, attack wood and foster injurious Aphids. In the first of these papers, the authors discuss the importance of lizards in controlling ants in Utah, and state that 12 of 16 species and subspecies collected there since 1930 were found to have fed on ants as well as other injurious insects, 1,462 of the 4,671 stomachs examined containing a total of 14,753 ants. One of the commonest and most useful species was *Sceloporus graciosus* [*cf. R.A.E.*, A **35** 400]. In the second paper, the authors deal similarly with birds and record that 70 of 108 species examined were found to have fed on ants, 688 of 3,007 stomachs examined containing 14,046 ants. The detailed results are shown in tables in both papers.

SIEGLER (E. H.) & GERTLER (S. I.). **Toxicity of some N-substituted Phthalimides to Codling Moth Larvae.**—*J. econ. Ent.* **39** no. 4 p. 549. Menasha, Wis., 1946.

A table is given showing the results of tests on larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., by the apple-plug method [*cf. R.A.E.*, A **23** 174] with 25 N-substituted phthalimides used at the rate of 4 lb. per 20 U.S. gals. ethyl alcohol (95 per cent.) and 80 U.S. gals. water. The most toxic, N-1-naphthylphthalimide, was less effective than lead arsenate, and the others had little or no toxicity.

ISELY (D.) & MINER (F. D.). **Control of Aphids on Spinach with Hexachlorocyclohexane.**—*J. econ. Ent.* **39** no. 4 p. 550, 1 ref. Menasha, Wis., 1946.

It is difficult to control *Myzus persicae*, Sulz., on spinach by means of dusts or sprays, because the low-growing character of the plants makes it impossible to secure contact with more than a small proportion of the Aphids feeding on the underside of the leaves. Dusts of rotenone, alone or with sulphur, kill the Aphids with which they come into contact, but apparently have little value under field conditions, and temperatures are generally too low during the growing season for nicotine to be effective. In small-scale tests carried out in Arkansas, the γ isomer of benzene hexachloride (hexachlorcyclohexane) gave

striking control, apparently owing to a fumigating effect. In greenhouse tests at 75°F., heavy applications of dusts containing 0·5, 0·75 and 1·5 per cent. γ isomer gave complete mortality on heavily infested plants, and appeared to prevent reinfestation for two weeks. In small field-plot tests, in which counts of Aphids were made before and two or six days after dusting, dusts of 0·75 per cent. γ isomer in pyrophyllite, applied at 70 lb. or more per acre early in March when the temperature was 55–58°F., reduced the Aphid population to 4·2 per cent. of its original numbers and 1·5 per cent. of its numbers on undusted plots. No other dust tested was effective.

In tests with other Aphids, the γ isomer was equally effective against *Rhopalosiphum pseudobrassicae*, Davis, on mustard but less so against *Macrosiphum avenae*, F. (*granarium*, Kby.), on oats, possibly because the plants were taller and the concentration of gas about the Aphids was less.

Bissell (T. L.) & du Pree (M.). **Insects in shelled Peanuts in Relation to Storage and Bagging.**—*J. econ. Ent.* **39** no. 4 pp. 550–552, 1 fig. Menasha, Wis., 1946.

Examination of shelled ground-nuts [*Arachis hypogaea*] from different localities in Georgia in January–April 1946 showed that infestation by insects other than Psocids was much lower in recently shelled ground-nuts than in a lot that had been shelled and stored for some months. The insects found included *Oryzaephilus surinamensis*, L., *Ephestia cautella*, Wlk., and *Tribolium* sp., which are very destructive to shelled ground-nuts, Psocids, *Lasioderma serricorne*, F., and species of *Carpophilus* and *Laemophloeus*, which are suspected of being injurious, and six species that were considered to be accidental.

After all visible insects had been removed, the ground-nuts were mixed together and stored in closed bags of 10 oz. jute (11–12 threads to the inch) or coarse aeroplane cloth of heavy cotton (60 × 104 threads per square inch) for eight weeks from 26th April in a barn containing a variety of foodstuffs or for nine in an artificially infested cabinet kept at a temperature of 80–85°F. and 60–70 per cent. relative humidity. At the end of this time, 12 species of insects and a mite were found in the bags, *O. surinamensis* being the commonest, except for Psocids. All the ten jute bags contained insects, the numbers ranging from 87 to 166 in the barn and from 15 to 57 in the cabinet, and the ground-nuts showed considerable webbing from Lepidopterous larvae that had fed and left the bags to pupate. Examination of these bags showed that the mesh was big enough to admit adults and larvae. Of the ten cotton bags, one in the barn and three in the cabinet contained no insects and one other none but Psocids. Of the remaining five, two had open corners due to imperfect sewing and a third had a loosely tied top ; these three contained 66 of the 74 insects found in all the cotton bags.

It is concluded that ground-nuts stored in jute bags will become heavily infested and that infestation can be materially reduced or eliminated by storing in heavy cotton bags.

Acree jr. (F.), Jacobson (M.) & Haller (H. L.). **The Structure of Affinin, the insecticidal Amide from** *Erigeron affinis* **D. C.**—*J. organic Chem.* **10** no. 5 pp. 449–451, 5 refs. Baltimore, Md., 1945.

The authors describe experiments on the structure of the insecticidal amide designated affinin [*cf. R.A.E.*, A **34** 359], obtained from the roots of the plant recorded as *Erigeron affinis* [but now considered to be *Heliopsis longipes* (*cf.* **36** 12)], from which they conclude that it is the pure compound N-isobutyl-2,6,8-decatrienoamide.

Taylor (T. H. C.). **Some East African Species of *Lygus*, with Notes on their Host Plants.**—*Bull. ent. Res.* **38** pt. 2 pp. 233–258, 96 figs., 8 refs. London, 1947.

The Mirids dealt with in this revision belong to a group that the author calls the *simonyi* group, and a study of them was undertaken in the course of work in which it was shown that the common pest of cotton in Uganda is *Lygus vosseleri*, Popp., and not *L. simonyi*, Reut. [*R.A.E.*, A **35** 213]. They comprise 23 species, of which 15 are new, from Uganda, one from Tanganyika (Kilimandjaro), and one new one from Kenya. All are described, and a key to them is given. They were originally differentiated by the male genitalia, the relevant characters of which are described, but it was then found that they could be distinguished by more readily visible characters, and these are used in the key. The new species from Uganda include *L. palus*, which breeds on mango, cashew (*Anacardium occidentale*), *Caesalpinia sepiaria*, *Entada abyssinica* and *Triumfetta*; *L. virens*, which breeds abundantly on sorghum and on trees, notably *E. abyssinica* and *Cedrela* sp., and probably mango, and rarely on cotton; *L. infirmus*, which breeds on *Cajanus cajan* (*indicus*) and *Caesalpinia sepiaria*; *L. ricini*, which breeds on castor (*Ricinus communis*) [*cf. loc. cit.*] and of which nymphs have been found on sorghum and adults on cotton; and *L. arboreus*, which breeds on avocado, *C. sepiaria* and hemp (*Cannabis sativa*) and of which the adults frequent coffee. Other species found on coffee in Uganda are *L. ghesquierei*, Schout., which has often been confused with *L. arboreus*, and *L. coffeae*, China, which does not belong to the *simonyi* group. Adults of *L. nairobiensis*, Popp., which breeds on herbaceous plants, including *Cajanus cajan* and hemp, occasionally visit cotton in Uganda, but do not breed on it.

Collenette (C. L.). **The Identity of *Phalaena chrysorrhoea*, Linnaeus, 1758.**—*Bull. ent. Res.* **38** pt. 2 pp. 259–261. London, 1947.

The object of this paper is to show that the correct names for the Lymantriid moths commonly known as the brown-tail and the gold-tail are *Euproctis chrysorrhoea*, L., and *E. similis*, Fuessly, respectively. As regards the specific names, this is the common European practice, but is contrary to the views of Rothschild [*R.A.E.*, A **5** 496] and others [**13** 35; **17** 151], according to which the name [*Arctornis*] *chrysorrhoea* is applied to the gold-tail [and *Nygmia phaeorrhoea*, Don., to the brown-tail]. The author points out that Linnaeus' collection includes both species and that his description (1758) of *chrysorrhoea* might apply to either, but that one specimen in the collection is labelled *chrysorrhoea* in Linnaeus' handwriting and that it is a brown-tail. Of the seven references to *chrysorrhoea* cited by him in 1758, two are certainly to the gold-tail and one (Roesel) to the brown-tail, but only the last illustrates the two species and brings out the differences between them. In 1763, Scopoli cited Roesel's illustration of the brown-tail under *chryssorhoea*, without mentioning the gold-tail, and of two additional references cited by Linnaeus in 1766, one is to Scopoli and the other to a work in which the insect is styled "cul brun". Finally Fuessly (1775) named the gold-tail *Phalaena similis* and cited Roesel's illustrations of the gold-tail and the brown-tail for this species and *P. chrysorrhoea*, respectively.

As regards the genus, *Euproctis*, Hb., 1819 (type *P. chrysorrhoea*) is not congeneric with *Arctornis*, Germ., 1811, and is earlier than *Nygmia*, Hb., 1820. Many systematists place *E. chrysorrhoea* and *E. similis* in different genera, but a study of African and Oriental species has led the author to conclude that they are congeneric.

RAINEY (R. C.). **Notes on the Tachinid Parasites of Cotton Stainers (*Dysdercus* spp., Pyrrhocoridae) in South Africa.**—*Bull. ent. Res.* **38** pt. 2 pp. 305–310, 11 refs. London, 1947.

Early searches for parasites of cotton stainers (*Dysdercus*) in South Africa gave negative results, and the four unidentified species of Tachinids reared from them at Barberton, in the eastern Transvaal, in 1931 [*R.A.E.*, A **20** 243] were apparently of little importance, since damage to cotton in that year was the heaviest on record. In Uganda, however, parasitism by *Bogosiella fasciata*, F., was found to be heavy at times, especially on wild food-plants [**26** 375]. In further investigations at Barberton in 1940, about 1,900 adults and fifth-instar nymphs of *Dysdercus* were collected from heavily-infested late cotton on 24th and 31st May and 14th June and kept in an open-air insectary at temperatures averaging 57–60°F., with cottonseed as food. *Dysdercus nigrofasciatus*, Stål, comprised 99 per cent. of the examples collected, and the Tachinids, *Alophora nasalis*, Bez., of which *A. nigeriensis*, Villen. [*cf.* **24** 621] and *Hyalomya cuthbertsoni*, Curr. [*cf.* **26** 90] have been found to be synonyms, and *B. fasciata* were reared from it. *Alophora* parasitised 18, 26 and 18 per cent. of the adult males and 19, 27 and 15 per cent. of the adult females in the three collections, respectively, and 7 and 0 per cent. of the nymphs in the first two of them. The percentages for *Bogosiella* were 2 in all cases, except among nymphs collected on 24th May and females collected on 31st May, on which they were 7 and 1, respectively. It is considered that the increase of parasitism in the second collection was due to a relatively high level of parasitism among immigrant adults, and the decrease in the third to emigration [*cf.* **27** 489] and the emergence of adults bred in the crop. The small proportion of nymphs attacked by *Alophora* may be due to a preference for adult hosts or to a scarcity of parasite adults in the area under observation ; most of the parasitised adults obtained had probably been attacked before entering it.

A. nasalis has been recorded from Cape Province to Kenya and Nigeria and occurs most frequently in regions with an annual rainfall of 20–40 ins., whereas *B. fasciata*, which ranges from Sierra Leone to Nyasaland and from southern Sudan to Pondoland, is commonest where the annual rainfall is 40–80 ins. ; the average rainfall at Barberton is 28 ins.

In earlier work at Barberton, it was noted that *A. nasalis* always pupated on the surface of the ground, and in the present investigations, the pupae developed satisfactorily without any attempt to keep the puparia moist. Considerable moisture is necessary for the pupal development of *B. fasciata*, which pupates in the soil [**26** 375]. At 80°F., the pupal stages of *A. nasalis* and *B. fasciata* averaged 15·3 and 14 days, respectively. Emergence of larvae of *A. nasalis* from hosts collected as adults was frequent for 9–10 weeks after collection ; the last individuals emerged after 12 weeks, when over 65 per cent. of unparasitised *Dysdercus* collected at the same time were dead. Both parasites continued to emerge from nymphs until the 15th week after collection, and several nymphs completed their final moult before the parasites left them. The protracted larval development of *A. nasalis* may be of importance in its survival during the cool, dry season from July to November, when only a few widely-dispersed adults of *Dysdercus* are present.

Both parasites were also reared from *D. nigrofasciatus* collected in Swaziland on *Hibiscus calyphyllus*, which is the most important local wild food-plant, and *A. nasalis* from *D. fasciatus*, Sign., and *D. intermedius*, Dist., on cotton at Barberton. *A. nasalis* has also been recorded in the literature from *D. superstitiosus*, F. [**24** 621] and the Pentatomid, *Agonoscelis pubescens*, Thnb. (*versicolor*, F.), and *B. fasciata* from several species of *Dysdercus* [**26** 375], including *D. cardinalis*, Gerst.

Although the degree of parasitism observed in these investigations was higher than that previously recorded, parasitised stainers were long-lived and the parasites had little effect on the outbreak of 1931 ; it is therefore concluded that their economic value is slight.

JONES (B. M.). **An Experiment with DDT against Pests of Stored Products.**—*Bull. ent. Res.* **38** pt. 2 pp. 347–352, 3 figs., 3 refs. London, 1947.

Preliminary tests having shown that a deposit of DDT was toxic to adults of *Calandra oryzae*, L., *Tribolium castaneum*, Hbst., *Rhizopertha dominica*, F., and *Laemophloeus* spp., though not to larvae of *Corcyra cephalonica*, Staint., and *Ephestia cautella*, Wlk., and that a considerable amount of migration of insects infesting bagged commodities occurred over the surface of the bags at night, experiments were carried out on the effect of spraying the bags with an emulsified solution to give an external deposit of DDT. The concentrate employed contained 30 per cent. technical DDT (60·5 per cent. p,p′ isomer), 40·01 per cent. solvent naphtha, 1·45 per cent. casein, 0·64 per cent. phenol, 0·5 per cent. Agral W.E.M., 0·22 per cent. potassium hydroxide, 26·8 per cent. water and 0·38 per cent. ethyl alcohol, and the spray was prepared by thoroughly stirring 20 parts concentrate in 20 parts water, and adding another 55 parts water and 25 parts gum-arabic solution (16 per cent. in water), with further stirring. The gum arabic reduced the tendency of the emulsion to penetrate the sacking and retained the DDT as an external layer when the volatile components of the spray evaporated. The prepared spray, which remained stable for five hours, was atomised so that the spray mist settled on small jute bags to produce a uniform deposit of approximately 50 mg. DDT per sq. ft. A treated bag filled with rice and flour containing 41 examples of *C. oryzae*, 47 of *Laemophloeus* spp., 80 of *R. dominica* and 67 of *T. castaneum* was placed between and in contact with a treated and an untreated bag containing uninfested rice and flour, in a small glass tank. The bags were examined each day at hourly intervals and the insects that had been knocked down by the DDT removed ; all such insects died in 6–15 hours. There was little or no activity on the surface during daylight. After 24 hours, 60 per cent. of the original number of *T. castaneum* and 80 per cent. of *Laemophloeus* spp. had been killed, and after a further 24 hours, about 60 per cent. of both the other species were dead. After a week, the mean percentage mortality was 91 ; 4 per cent. of the insects that migrated to the bag surface passed to other bags, but none survived.

The duration of effectiveness of the DDT was tested by confining test insects on the surface of a treated bag for three hours at intervals of five days, and noting how many died in the next 24 hours. Mortality in 24 hours was complete in *Laemophloeus* throughout the test period of 80 days, but was only partial in the other species after 50–60 days.

Evidence that the spray would not penetrate the sacking and contaminate the contents was obtained by tests in which filter papers were placed against the sacking in bags filled with rice, the bags were sprayed, and the mortality of insects subsequently confined on the filter papers was compared with that of insects on untreated filter papers and papers that had been sprayed directly.

SIMMONDS (F. J.). **The Biology of the Parasites of *Loxostege sticticalis*, L., in North America—*Meteorus loxostegei*, Vier. (Braconidae, Meteorinae).**—*Bull. ent. Res.* **38** pt. 2 pp. 373–379, 6 figs., 10 refs. London, 1947.

In this paper, which is one of a series on the parasites of *Loxostege sticticalis*, L., in Canada and the United States [*R.A.E.*, A **35** 294], the bionomics and all stages of *Meteorus loxostegei*, Vier., are described. This Braconid is confined to North America, where it occurs from Massachusetts to New Mexico, Colorado and Alberta, and is probably second to *Cremnops* (*Bracon*) *vulgaris*, Cress. [*cf. loc. cit.*] in controlling *L. sticticalis*, but appears to be more variable

in numbers. It has also been recorded in the United States from *L. commixtalis*, Wlk. [**21** 421], *Phlyctaenia tertialis*, Gn. [**18** 116], *Pyrausta futilalis*, Led., *P. nubilalis*, Hb., and *P. penitalis*, Grote. The first-instar larva overwinters within the hibernating larva of *L. sticticalis* and does not develop further until the diapause of the host comes to an end. The adult parasites emerge about the same time as the adults of *Loxostege*, the males rather earlier than the females. The percentage of females was 61·4 among adults that emerged from host larvae collected in 1945 and 58·3 among those reared in the laboratory from mated females. Unmated females produced male offspring. The processes of mating, which takes place shortly after emergence, and oviposition, are described. Larvae of all sizes were readily attacked in the laboratory, but small ones were the most suitable since they are least active. Males and females kept in small cages at 75°F. and given honey solution, raisins, sugar and water survived for several weeks. Two females that were offered as many hosts as they would attack each day attacked totals of 316 and 239, respectively, and oviposited in about 80 per cent. of them. At 75°F., the larvae hatched in about six days and moulted to the second instar when the changes that precede pupation began in the host. The second instar lasted one day, and the third-instar larva remained within the host larva until fully fed, when it emerged and pupated, after a prepupal period of two days, in a cocoon constructed within that of its host. Parasites in larvae that did not enter diapause completed their development in 18 days at 75°F., of which eight days were passed within the cocoon. Parasitised larvae are generally stunted in growth and remain alive within their cocoons for some time after the parasite has emerged.

M. loxostegei was not found in some 2,000 overwintering *Loxostege* larvae collected in Montana in 1941, but in 1942 it comprised 0·32 and in 1945 3·5–4 per cent. of the total material collected; in the latter year, it was next in abundance to *C. vulgaris* and parasitised 87·8 per cent. of the overwintering larvae in one field. Two hyperparasites, *Perilampus similis*, Cwfd., and *Mesochorus perniciosus*, Vier., emerged from some of the cocoons of *Meteorus loxostegei*, the former from about 6 per cent. of them and the latter from only four cocoons. In the laboratory, *M. loxostegei* was found to be intrinsically superior to *C. vulgaris*, *Neopristomerus* (*Pristomerus*) *appalachianus* var. *dorsocastaneus*, Vier., and *Campoplex sulcatellus*, Vier. Since its development after diapause is extremely rapid and the host still contains nutritive material after it has emerged, a second parasite species can develop successfully in the latter, provided that the eggs are laid while it is still feeding. Parasites that develop in this way after the emergence of *Meteorus* included *Achaetoneura samiae*, Webber, *Euphorocera omissa*, Reinh., and the external parasite, *Cryptus inornatus*, Pratt.

As *M. loxostegei* appeared a promising parasite to introduce into South Africa [*cf. loc. cit.*], attempts were made to rear it on a large scale in the laboratory, but the host was attacked by a disease that rendered this impossible. Larvae of *Ephestia kuehniella*, Zell., and *Cydia* (*Carpocapsa*) *pomonella*, L., were attacked by the ovipositing females, especially if they were first coated with the body-fluids from *L. sticticalis* or *Pyrausta nubilalis*, but mortality of the parasites was high [*cf.* **33** 75]; a stock could, however, be maintained by this method when *L. sticticalis* was not available.

Russo (G.). **Un nuovo Piralide : *Mabra russoi* Schaus dannoso alla canna da zucchero nella Repubblica Dominicana (Antille).** [A new Pyralid harmful to Sugar-cane in the Dominican Republic.]—*Riv. Biol. colon.* **3** fasc. 1–2 pp. 139–144, 2 figs. Rome, 1940. (With Summaries in English, French and German.)

The author describes the larva, pupa and adults of both sexes of the Pyralid, *Mabra russoi*, sp. n.,* which was found in 1929 damaging sugar-cane in the

* The author attributes this species to Dr. W. Schaus, but no evidence of a description of it by Schaus has been traced.—*Ed.*

eastern part of the Dominican Republic. The larvae mined the stalks and buds, feeding on the young leaves, of which they left only the main veins. They also obstructed normal growth by binding the buds with silken threads and facilitated attack by fungi and bacteria. They pupated in silken cocoons attached to a leaf and shielded by another small piece of leaf tissue. The adults emerged after about a fortnight ; they were crepuscular and sheltered principally in varieties with thick foliage. A Chalcid thought to be *Brachymeria ovata*, Say, emerged from the pupae in fair numbers.

Lazzari (M.) & Servadei (A.). **Le fumigazioni cianidriche delle piante da vivaio nel pistoiese (Ia. nota.).** [Fumigation of Nursery Stock with Hydrocyanic Acid Gas in the Province of Pistoia (1st Note.).]—*Redia* **27** pp. 1–17, 11 pls., 30 refs. Florence, 1941.

The production of orchard and other nursery stock is an important industry in the Italian Province of Pistoia, and in view of the desirability of disinfesting it from Coccids before despatch, experiments on fumigation with hydrocyanic acid gas were begun in 1937. Since fumigation is mostly required in winter, when temperatures are seldom much above freezing point, tents proved unsuitable for the purpose, and special huts constructed of masonry, which could be heated internally, were devised. They were fitted with a fan to circulate the gas, a chimney through which it could be eliminated, a window, and a device controlled from the outside by which the required amount of sodium cyanide could be lowered into a bucket containing sulphuric acid and water. These components were used in the proportion of 1 : 1·5 : 2, and it was found from a series of tests, the results of which are given in detail, that complete mortality was caused by fumigation for about 45 minutes at the rate of 3–5 oz. sodium cyanide per 1,000 cu. ft. at a temperature of 19–20°C. [66·2–68°F.], without injury to the plants. Such huts have been in widespread use for three years, and have proved completely satisfactory.

Servadei (A.) & Venturi (F.). **Esperienze di lotta contro gli insetti dei granai con formiato di metile.** [Experiments with Methyl Formate against Grain Insects.]—*Redia* **27** pp. 45–92, 2 figs., 2 refs. Florence, 1941.

An account is given of tests carried out in Italy in 1940 to assess the insecticidal properties of methyl formate and its value as a fumigant for the control of insects in stored grain [*cf. R.A.E.*, A **16** 464 ; **32** 67]. It was found to be unsuitable for this purpose because, although it had good properties of evaporation and diffusion in air, and proved toxic to *Calandra granaria*, L. (adults), *Sitotroga cerealella*, Ol. (adults and larvae) and various other insects in the laboratory, it did not penetrate beyond the top six inches of a mass of grain.

Servadei (A.). **Contributi alla conoscenza dell'entomofauna delle leguminose foraggere. II.** *Pteronidea myosotidis* **F. (Hymenoptera Symphyta).** [Contributions to the Knowledge of the Insect Fauna of leguminous Fodder Plants. II. *Nematus myosotidis*.]—*Redia* **27** pp. 93–134, 2 pls., 19 figs., 10 refs. Florence, 1941.

In this paper, which is the second of a series [*cf. R.A.E.*, A **28** 499], an account is given of field and laboratory observations made near Florence in 1938–40 on the bionomics of *Nematus* (*Pteronidea*) *myosotidis*, F., a sawfly that is common throughout Italy on wild and cultivated clovers and is of potential

importance as a pest. Its distribution is reviewed, and the egg, larva and adults of both sexes are fully described. There were three generations a year, the adults emerging in April, June and August–September and the larvae of the third overwintering in cocoons in the soil. Females laid 60–90 eggs in the leaves in a period of 2–3 days, and the larvae fed on the leaves. Spring and summer larvae pupated between the leaves or on the soil. Unfertilised females gave rise to male offspring only. Larvae of all three generations were parasitised by an Ichneumonid of the genus *Mesoleius*, which emerged from the cocoons but was not abundant.

Melis (A.). **Contributo alla conoscenza dell'Apion del carciofo,** *Apion* (*Ceratapion*) *damryi* **Desbr.** [A Contribution to the Knowledge of the Artichoke Weevil, *A. damryi*.]—*Redia* **27** pp. 135–165, 5 pls., 18 figs., 5 refs. Florence, 1941.

The author reviews the local distribution and describes all stages of *Apion damryi*, Desbr., which infests artichoke (*Cynara scolymus*) in Italy. A study of the bionomics of this weevil was begun in 1937 near Florence, where the adults emerged in the second half of March from their hibernation quarters among dry leaves and stalks or in crevices of the bark of vines and trees near artichoke plantations. They fed on the leaves of artichoke and oviposited from late March or early April until 15–20th May. The eggs were laid singly, mostly in cells cut in the main veins of the leaves or in the flower stalks, but sometimes on the upper and lower surfaces of the leaves, close to the main veins. The larvae hatched in 10–12 days, mined in the veins or stems and pupated in cocoons in cells at the ends of the galleries. The larval and pupal stages lasted about 14 and 20 days, respectively, and the adult remained for a few days in the cocoon. In laboratory rearings, the adults were first observed at the end of May. During the summer, adults were found resting in shelters similar to those used for hibernation ; no further damage to artichokes was observed and the author considers that there was probably only one generation in the year. A species of *Pteromalus* and a Braconid, possibly *Triaspis* sp., were reared from the larvae and pupae.

The chief damage to the plants was caused by the tunnelling of the larvae, which caused a reduction in the size and number of the flower heads. Suggested control methods comprise hand-collection of the adults before these have oviposited, spraying with nicotine sulphate against the eggs, and the removal of badly infested leaves or plants to destroy the larvae and pupae. Arsenical sprays or dusts are effective against the adults, but are not economic unless required for the control of other pests as well.

Schedl (K. E.). **Bestimmungstabellen der palaearktischen Borkenkäfer. Teil I. Die Gattung** *Crypturgus* **Er.** [Keys to the Palaearctic Bark-beetles. Part I. The Genus *Crypturgus*, Er.]—*Zbl. GesGeb. Ent.* **1** pt. 1 pp. 1–15. Lienz, 1946. **II. Die Gattung** *Blastophagus* **Eichh.** [II. The Genus *Myelophilus*, Eichh. (*Blastophagus*, Eichh.).]—*T.c.* pt. 2 pp. 50–58.

In the first part of this paper, the author gives a key to the adults of the Palaearctic species of *Crypturgus*, followed by a list of species showing their synonyms, distribution and food-plants, with descriptions of the adults. He considers that *C. maulei*, Roub. [*cf. R.A.E.*, A **13** 146] and *C. cylindricollis*, Egg. [*cf.* **30** 164], are synonyms of *C. pusillus*, Gylh., that *C. parallelocollis*, Eichh. [*cf.* **11** 26] is a variety or subspecies of it, and that *C. corsicus*, Egg. [**12** 25], and *C. apfelbecki*, Egg. [*cf.* **30** 164] are synonyms of *C. cinereus*, Hbst. *C. barbeyi*, Strohm., of which the original description is quoted [**18** 179],

is not included in the key, and the author inclines to the view that it is a synonym of *C. numidicus*, Ferr. [*cf.* **13** 180].

In the second part, he deals similarly with the genus *Myelophilus* (*Blastophagus*).

SCHEDL (K. E.). **Starker Weidenbohrerbefall an Esche.** [Severe Goat-moth Attack on Ash.]—*Zbl. GesGeb. Ent.* **1** pt. 2 pp. 59–63, 2 figs. Lienz, 1946.

In 1945, a group of pollard ash trees about 50 years old in Verdun was observed to be severely injured by larvae of *Cossus cossus*, L. The lower parts of the trunks showed large swellings from which, in many instances, the bark had fallen away or could be easily detached, so that the feeding galleries of the larvae were clearly visible. Among the deep grooves formed in the sapwood, holes were observed leading into the wood, where the full-fed larvae overwinter. Frass was expelled in August, but none was observed after September. Of 132 trees, 118 were damaged, nearly 50 of them severely. The trunks had been painted with lime some years before, and most of the feeding occurred below the level of the whitewash, some of it in exposed roots. The lime had apparently exerted a repellent effect on the ovipositing females.

This heavy *Cossus* attack on trees that were otherwise healthy is attributed to the repeated lopping, which may have weakened them. Liming the trunks appears to be an effective method of preventing infestation, but it should be carried out down to ground level and the roots not allowed to become exposed.

PAPERS NOTICED BY TITLE ONLY.

CHAUVIN (R.). **Chimiotropismes des insectes** [a review of literature].—*Ann. Epiphyt.* (N.S.) **11** fasc. 1–2 pp. 11–17, 1 fig., 19 refs. Paris, 1945.

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COMPERE (H.). **A new Species of Encyrtidae parasitic in** *Coccus hesperidum*, **L.** [*Adelencyrtus simmondsi*, sp. n., in South Australia.]—*Bull. ent. Res.* **38** pt. 2 pp. 281–283, 1 pl., 1 fig. London, 1947.

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